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THE ELECTRIC LIGHTING ACT.

(*Continued from page* 84.)

We now come to the compulsory supply of electricity for public lighting by incandescence, and the regulations compiled by Mr. Moulton demand but little further explanation at our hands.

We should imagine that as far as the price charged for the electric light is concerned, arbitration will be oftentimes required until such advance has been made as will permit the adoption of some settled basis upon which to act. This matter is really one which demands very important consideration, but it does not seem possible to deal with it at present more effectually than is proposed in the "Provisional Orders." Many suggestions have been and will be made, but we must wait for actual working results in order to arrive at a definite idea of the *modus operandi* to be adopted, so as to give general satisfaction all round. The use of arc lamps for public street lighting should not occasion any difficulty whatever, for the supply of electricity to these lamps may be on such system as the *undertakers* shall select. It will be, however, absolutely essential that street lamps be entirely independent of those used in shops and houses, although we are not quite sure that separate mains for the two systems are contemplated in these "Orders." It is not probable that any break-down would occur in both street and house circuits at the same time; but if house and street lighting should both be on the same circuit, a mishap would be a grave matter indeed. The supply of power should also, to be both economical and readily applied, be obtained from an independent source.

It is very necessary that the consumer shall have a definite knowledge of the maximum current he is likely to require (this could easily be arrived at by a consultation of the undertakers, if advisable, or with an independent electrical engineer), otherwise the undertakers would not know what "leads" to run into the consumers' premises.

The succeeding paragraph to the one here alluded to is provided for the purpose of preventing any extravagance, or, in other words, the consumer must be prepared to show that he actually requires for *bonâ fide* use the current stipulated for. It would not be a difficult matter, however, for the undertakers to provide means whereby it should be impossible for the consumer to deceive them in this matter. In respect to large buildings, it will be seen that the undertakers may look upon a number of persons or firms using any one such building as requiring but *one supply*, but of course if payment *per lamp* be agreed upon such a view would be unnecessary. The substitution of other systems for the direct or storage methods will probably be necessary in time, and Mr. Moulton no doubt believes that fresh discoveries are on the verge of becoming public. It may safely be left with the Board of Trade to decide how far alterations shall take place which are at all likely to interfere with the public convenience.

COMPULSORY SUPPLY.

The undertakers shall (so far as required so to do by the local authorities having charge of such streets or parts of streets) supply electricity for public lighting, on the incandescent principle, along any streets and parts of streets along which they have laid down, and are maintaining distributing mains, during the hours in which they are actually working the same, on such terms, as to price and otherwise, as shall be agreed upon between the undertakers and such local authorities, or, in case of difference, *shall be settled by arbitration.*

The undertakers shall also (so far as required so to do by the local authorities having charge of such streets or parts of streets, and within a reasonable time of their receiving notice of such requirement) lay down, maintain, and work electric lines for public lighting by arc-lamps in any streets or parts of streets along which they have laid down and are maintaining distributing mains. The supply of electricity to such arc-lamps shall be on the series or such other system as the undertakers select, and shall be maintained during such hours as the said local authorities shall require, and the price and details of such supply shall be settled by agreement, or, in case of difference, by arbitration.

(A.) The undertakers shall, when required so to do by the owner or occupier of any premises situate *within fifty feet* from any distributing main of the undertakers, the supply through which has not been discontinued under the provisions of Sections 32 and 34 of this Order (see footnote), give and continue to give a supply of electricity in conformity to the provisions of this Order to such premises, according to the provisions of this Order, and they shall furnish and lay down such service lines and apparatus as may be necessary for such purpose, subject to the conditions following, that is to say: The cost of furnishing and laying so much of any service line for the supply of electricity to any owner or occupier, as may be laid upon the property of such owner, or in the possession of such occupier, and so much of any such service line as may be laid for a greater distance than *twenty feet* from any distributing main of the undertakers, although not on such property, and of furnishing and fixing any apparatus rendered necessary by such service line or supply and used exclusively in connection therewith, shall be defrayed by such owner or occupier.

(B.) The provisions of Section 11 of "The Gasworks Clauses Act, 1871," shall, save so far as modified by the provisions of the last preceding Section of this Order, apply to any owner or occupier of premises requiring a supply under the provisions of the preceding Section. Such Section shall be construed as if gas meant electricity, and as if pipe meant the service line and apparatus referred to in the preceding Section. And whenever any consumer is required by the provisions of this Order to give security to the undertakers, the provisions of Section 16 of "The Gasworks Clauses Act, 1871," shall apply.

In case any consumer (other than local authorities acting under the provisions of Sections 16, 24, and 25 of this Order) desires to be supplied with electricity under the provisions of this Order, he may be required by the undertakers *to state the maximum current* with which he desires to be supplied, and he shall not be entitled to exceed such quantity at any time. If he desires that such maximum should be altered, the undertakers may require him to pay the cost occasioned by such alteration; and in case he desires to increase the said maximum he shall, if required by the undertakers, comply with the provisions of Sections A and B, as though he were requiring a supply under such sections.

In case the maximum current which a consumer may require the undertakers to supply to him, under the provisions of the last preceding Section, shall be greater than any current which he can reasonably require for the purpose of lighting his premises, the undertakers may decline to supply the same, unless they are reasonably satisfied that the consumption upon such premises will be such as fairly to entitle him to such a maximum; and in case such maximum current is greater *than fifty ampères*, they may divide such supply and cause the same to be given at *more than one pair of poles*, so that the maximum current at each pair of poles shall not exceed *fifty ampères.*

The undertakers shall not be required *(save by agreement)* to treat the supply to any one building as other than one supply, or to regard in any way the distribution to the various individual consumers of the supply to such building.

The undertakers may, with the permission of the Board of Trade, and on such terms and subject to such regulations as the *Board of Trade shall approve, substitute for* any part of the supply which they are required to give by their distributing mains, under the provisions of this Order, such a supply on any other system than the direct storage system (with or without earth returns), or a combination thereof, as shall in the opinion of the Board of Trade be suitable and efficient.

The undertakers may at any time make application to the Board of Trade *to be released from their obligation* to lay

* (32).

down, maintain, or work any mains in any streets or parts of streets in which they are compellable to lay down, maintain, or work such mains under the provisions of this Order, either on the ground that such mains are incapable of being laid down, maintained, or worked to a reasonable profit, or for any other sufficient reason; and the Board of Trade may, in their discretion, grant such application either unconditionally or on such terms as they shall think fit, and in the latter case the undertakers shall be released accordingly from their said obligations in relation to such streets or parts of streets.

Subject to the provisions of this Order, the undertakers shall not *be compellable to supply any person on the series system, or on any other system than as hereinbefore provided, or to connect any premises with any existing circuit worked on such series or other system*, and they shall not be compellable to lay down or work mains or supply electricity in any district or during any hours or in any manner save so far as it is otherwise expressly provided therein.

* In case the undertakers shall lay down and work mains, or supply electricity in other parts *of the area of supply, or at other hours, or in other or different manner, in addition to the supply they are compellable to give under the provisions of this Order*, they may at any time *discontinue so to do, either wholly or in part*, and may alter, take up, or remove the said mains, or any part of them, but they shall not so discontinue until after proper and sufficient notice of their intention so to do has been given to the persons whose supply will be affected thereby: Provided that nothing in this clause contained shall be deemed to affect any agreement voluntarily entered into between the undertakers and any consumer, or to relieve either party from the obligation duly to perform such contract.

It will be seen that the undertakers may, if they feel inclined, voluntarily supply electricity in other ways than those provided for under the provisions of this Order, and they are at liberty to give up such extra work if it is not considered—from commercial or other reasons—advisable to continue. Sufficient notice, however, must be accorded to those persons who are likely to be affected by the undertakers' *experiments*.

CONDITIONS AS TO PRICE.

The undertakers shall be entitled at their election to charge for the electricity supplied by them from their distributing mains (otherwise than by agreement) by any of the four following methods:—

(1) By the *quantity of energy* contained in the supply.

(2) By the *actual quantity of electricity* so supplied.

(3) By the *number of hours* during which the supply of electricity is actually used by the consumer and the maximum strength of such supply.

(4) By a *yearly or other rental* depending upon the *maximum strength* of the current required to be supplied.

The prices to be so charged by the undertakers for the electricity so supplied by them from their distributing mains shall not exceed those stated in that behalf in Schedule C in the 1st, 2nd, 3rd, and 4th Sections thereof respectively.

SCHEDULE C.

The term "*unit*" as used in this Schedule shall be deemed to mean the energy contained in a current of 1,000 *ampères* flowing under an electromotive force of one volt during one hour.

SECTION 1.

In case the undertakers shall elect to charge any consumer by the quantity of energy contained in the supply given to him, they shall be entitled to charge him at the following rates per quarter:—For any quantity up to 100 *units*, £3 10s.; for each unit over 100 units, 7d. per unit.

SECTION 2.

In case the undertakers shall elect to charge any consumer by the actual quantity of electricity supplied to him, they shall be entitled to charge him according to the rates set forth in Section 1 of this Schedule, the quantity of energy contained in the supply given to him being taken to be the product of the actual quantity of electricity supplied to him, and the standard pressure at the point of junction of the mains and the service lines by which he is supplied.

SECTION 3.

In case the undertakers shall elect to charge the consumer by the number of hours during which he shall actually use his supply, they shall be entitled to charge him at the rates specified in Section 2 of this Schedule, the quantity of electricity supplied to him being calculated on the supposition that the consumer uses the maximum current specified by him under the provisions of Section 28 of this Order during all the hours that he has used the supply.

SECTION 4.

In case the undertakers shall elect to charge the consumer a sum by way of quarterly or other rental, they shall be entitled to charge him the rates specified in Section 3 of this Schedule, the number of hours during which he has taken the supply being taken to be *three-fourths of the number of hours* during which the supply was continued during the period to which such rental relates.

* (34).

Subject to the provisions of this Order, and of the right of the consumer to require that he shall be charged according to some one or other of the methods above mentioned in cases where he is entitled to require a supply, the undertakers *may make any agreement with the consumer as to the price* to be charged for electricity, and may charge accordingly.

Nothing in this Order contained shall interfere with the validity of contracts *bonâ fide* made with the consumers for the supply of electricity where part of the *consideration of such contract on the undertakers' part is an extension of their mains.*

In case any consumer is charged for the electricity supplied to him in other ways than by measurement of the exact quantity of electricity or energy so supplied, it shall not be lawful for him, except by agreement with the company, *to store the energy* supplied by means of storage batteries or otherwise, so as to use the same in other than the hours of supply.

Of the four methods proposed for charging for the supply of electricity, a combination of (1) and (3) would be convenient enough, keeping the potential constant and measuring the current. But that which is most likely to be followed is (4), which is equivalent to the method adopted by the water companies, and electricity as applied for lighting purposes may be compared much more satisfactorily with water than with gas. If a householder requires extra water-taps or cisterns he is charged so much more per year for them. The inspectors of the water companies can always examine into the uses or abuses of the water supply. The rules and regulations dealing with meters for measuring the consumption of electricity are much the same as those connected with the present gas supply and do not call for much comment, as we are not yet acquainted with any apparatus sufficiently perfect to act as a meter in more than name. The following clause, with certain conditions, for "check" measurements is very necessary to allow for the undertakers' own security.

In case any person shall require to be supplied with electricity, the undertakers shall be entitled (by whatever method they may elect to charge him) to place upon his premises such meter or other apparatus as they shall desire, for the purpose of ascertaining or regulating either the amount of electricity or energy supplied to such consumer, or the number of hours during which such supply is given, or the maximum amount of such supply, or any other quantity or time connected therewith, but such meter shall not, *except by agreement*, be placed otherwise than *between the mains of the undertakers and the poles on the consumer's premises* at which the supply is given.

The undertakers are to have the right conditionally to fix the meters on the consumer's premises, and they undertake to keep them in order; in fact, as before said, the gas regulations with trifling alterations are here reproduced. On the "unit," proposed by Mr. Moulton, we shall offer some remarks next week.

(*To be continued.*)

THE EXPERIMENTS AT MIESBACH-MUNICH.

ONE might have thought that it would have been unnecessary to return to these experiments, but the Munich Electro-technical Commission of Experiments has just published its report, which necessitates its reproduction *in extenso*, followed by the comments which it suggests.

"By the aid of two dynamos (Gramme system) of identical construction, M. Marcel Deprez transmitted to Munich, at a distance of 57 kilometres, over an iron telegraph wire of 4·5 mm. diameter, the work furnished at Miesbach by a steam-engine. The receiver placed in the Crystal Palace kept in motion for eight hours a centrifugal pump, supplying a cascade about 2·5 mm. in height.

"The dynamos were set in motion for the first time on September 25th, at 7 p.m., and according to the report of Mr. Datterer, the engineer nominated by the committee, the receiver placed at Munich turned with a speed of 1,500 revolutions per minute; the brake used for measuring the work being weighted with 1·5 kilogrammes.

"A series of accidents, due to the fact that the machines were constructed for laboratory experiments and not for practical use, arrested, at the end of eight hours, the action of the machines, which was quite satisfactory until then. The coils round the ring of one of the machines broke, consequently the wires of the ring of 0·4 mm. diameter were injured, and had to be re-insulated. In the remote village

of Miesbach, these repairs could only be made with great difficulty, and required on the part of M. Marcel Deprez's assistants much patience and perseverance.

"On the 9th and 10th of October, when the Commission commenced the measurements, they could only attain at Miesbach, with the repaired machine, a speed of 1,600 revolutions per minute; the results obtained were consequently much less favourable than they had been at the normal speed of 2,000 revolutions attained at first.

"They could attain only for a few moments during the measurements the speed of 2,000 revolutions per minute; and again at the commencement of the experiments, one of the brushes of the machine was detached, which produced the extra current and completely destroyed the machine.

"The results obtained under these unfavourable circumstances, under the direction of Professors Dorn, Kittler, Pfeiffer, and Schröter, were as follows:—

	Ohms.
Resistance of the line - - - -	950·2
Resistance of the machine at Miesbach -	453·1
Resistance of the machine at Munich -	453·4

DATE.	Miesbach.		Munich.	
	Number of revolutions per minute.	Intensity in Amperes.	Number of revolutions per minute.	Difference of potential in volts.
H. M. M.		I.		E_2.
10th Oct., 12·32—37	1611	0·519	752	850

from which we derive

Difference of potential at Miesbach.	Electrical work.		Total Electrical work.	Loss by heating in the whole circuit.	Work disposable for the transport of power.	Per cent. of the total electrical work.
	External	in H.P.	in H.P.	in H.P.	in H.P.	
$E_1 = E_2 + 950 \times 1$	$E_1 I$	$\frac{E_1 I}{736}$	$E_1 I + I^2 \times 453{\cdot}1$	$I^2 \times 1856{\cdot}7$	$E^2 I - I^2 \times 453{\cdot}4$	
1,343 volts.	697	0·947	819 1·13	500 0·680	319 0·433	38·9

"The mechanical determinations of the work, undertaken at the same time as the electrical measurements, have given no exact results; in the first place, the machine at Munich had not a sufficiently firm base, and a part of the work was absorbed by the vibrations of the machine; then the Von Hefner-Alteneck dynamometer employed at Miesbach was constructed to measure forces of 15 H. P., and the limits of error of this apparatus were too great for the small power to be measured. The work obtained at Munich at the brake rose to 0·25 H. P.; there must be added to this the work absorbed by the vibrations of the machine; instead of making use of direct measurements, we should have a more exact estimate of the work expended at Miesbach, therefore, from the electrical work expended at Miesbach, and from the rendering of the machine at Munich, identical with that at Miesbach, a rendering which can be estimated by the figures given above, taking trepidations into account.

"As, in consequence of the numerous accidents recorded above, the results obtained during the measurements of the trial Commission are obviously less favourable than during the first experiments, M. Marcel Deprez determined to repeat the experiment at Munich with more strongly-built machines, and, we think, that then alone can be pronounced a decisive opinion on the rendering. We do not hesitate, however, to announce the success of the transport of force from Miesbach to Munich, which is important in every respect to electro-technical history.

"The Commission of trial for electro-technical experiments of the Munich Crystal Palace.

"Dr. V. BEETZ, President.

"Osc. V. MILLER, Secretary,"

This report fully justifies and confirms all the statements which have often been made in the ELECTRICAL REVIEW, *à propos* of these experiments of M. Marcel Deprez.

It proves first that the work disposable for the transport of power was only 38·9 per cent. of the total electrical work furnished by the generator. This is very far from the figure of 68 per cent. announced in the first papers to the Académie des Sciences.

But one can only accept this figure, 38·9 per cent., under the most express reserve, for these reasons:

The quantities actually measured by the Commission were:

1. The resistances of the machines and the line.
2. The current furnished by the machine at Miesbach.
3. The difference of potential at the terminals of the machine at Munich.

All the other elements have been deduced by simple calculations founded upon inacceptable hypotheses; they suppose, in fact, that the line is *perfectly insulated*, and that the intensity of the current which traverses the machines is the same at Miesbach and at Munich. The *two per cent.* (?) loss which M. Marcel Deprez recognised upon the line disappears for the Electro-technical Commission. This line, 114 kilometres long, of which M. Deprez admits that the insulation is *ordinary*, gives no loss between Miesbach and Munich! Its insulation is theoretically perfect. According to this hypothesis, we come to a disposable work of 39 per cent., considering, however, that the work measured at the brake at Munich was raised to 0·25 H. P., (one quarter of a horse-power) whilst the total electrical work, exclusive of the friction and other losses of the generator-machine reached 1·13 H. P.; there was actually obtained, *with the brake twenty two* per cent. of the total electrical energy produced by the generator, and consequently less than *twenty* per cent. of the work effectively expended upon the arbor of this machine.

The Commission mentions, it is true, the unfavourable conditions of the experiment, a too powerful dynamometer, the trepidations of the receiver, the accidents, and the special difficulties under which the experiment was conducted, &c., all of which is willingly admitted, but which do not suffice to make one consider as a success and an industrial result a transport of power in which it was necessary to employ two fine-wire Gramme machines, of very high price, to obtain in effective work *a quarter of a horse-power* with a mechanical return lower than *twenty per cent.* and machines which were rendered useless after a few hours' working.

The Miesbach-Munich experiment showed also that the relation of the velocities only represents *very roughly* the electrical return of the machines, since, in this particular case, the relation of velocities gave an electrical rendering of

$$\frac{752}{1{,}611} = 47 \text{ per cent.},$$

whilst the Commission, even by the theory of perfect insulation, only found 39 per cent.

The Commission does not appear to be, on the other hand, cognisant of the law of the return being equal to the relation of velocities, since these velocities do not figure in its calculations. It announces that M. Marcel Deprez has determined to repeat the experiment with more strongly-constructed machines, and that then alone can we pronounce a decisive opinion upon the result.

Long before the report of the Commission, further tests were deemed necessary and were advocated in the columns of the ELECTRICAL REVIEW, and it is to be hoped that when these new experiments take place those responsible for them will not be again content with these summary and altogether insufficient measurements—in this case imposed by circumstances—and that all the electrical and mechanical elements which enter into the question will be *measured*, instead of *estimating* and *calculating* them by making a series of inacceptable hypotheses and reserves—refined perhaps, but in which science and truth see nothing.

E. HOSPITALIER.

REVIEWS.

The Electric Light Popularly Explained. By A. BROMLEY HOLMES, Assoc. M. Inst. C.E. Third Edition. London: Bemrose and Sons, 23, Old Bailey.

THE general public who invest in industrial undertakings do not, as a rule, trouble themselves much about the scientific conditions under which such undertakings are carried on; they hear the matter talked about a great deal and they read articles in the daily papers on the subject, and then they invest their money and wait patiently until dividends are declared, or until the value of the shares becomes depreciated when they sell out. There are many, however, who like to know what they have got for their money—in fact, who want to know all about the business. It is, of course, a very difficult matter to initiate the unlearned public into the mysteries of electric lighting so that they may really understand all the ins and outs of the subject upon which so much depends, but still they may be taught a good deal if they evince a real desire to learn; to such we would decidedly recommend Mr. Holmes' work. It is often the case that in the preface of a work it is strenuously denied that any attempt at pretentiousness is shown, and yet the body of the book proves the contrary. We do not think that "The Electric Light" is open to such a criticism; it proposes to explain in plain language the means used for producing the electric light, and we think that Mr. Holmes has quite acted up to this profession. His explanations are excellent, and his remarks on particular points are very sensible. We are told on page 33 that "nominal horse-power has no definite meaning, and is usually a misleading expression. . . . . ." If this statement had been seen and taken to heart a few years ago it would have done more to prevent absurd and misleading comparisons than almost anything. Although Mr. Holmes' book contains but a little over 100 pages it puts to shame many works of a much larger size. We may add that the type, especially as regards the few formulæ which are given, is extremely good and effective.

We have received a complete edition of "A Dictionary of Electricity," by Henry Greer, advanced sheets of which we reviewed in a recent issue. We think Mr. Greer would have done better if he had contented himself by sending the advanced sheets only, our first opinion of the work was not of the highest, but we have now no hesitation in saying that Mr. Greer has shown himself quite incompetent to carry out the work he undertook.

HUSBANDS' TELEPHONIC APPARATUS.

THE modifications in telephonic apparatus which have suggested themselves to inventors since the Bell and Edison inventions were brought forward are, as is well known, very numerous. With one or two notable exceptions the new receiving apparatus has been most distinctly designed on the lines of the existing form of the Bell instrument. Great improvements have been effected and patented, but in every essential particular the instruments invented have been unquestionably improved forms of the Bell. In a patent recently published, Mr. José D. Husbands has described some remarkable and highly ingenious arrangements of magneto telephonic receivers which we believe are very efficient, and which in general arrangement are unlike the Bell instrument. We are not aware whether the inventor claims his inventions to be clear of the Bell patent, nor do we venture to express any opinion on this point, we bring the apparatus to notice solely for the reason of pointing out how greatly the *principle* of a magneto telephone can be varied. Mr. Husbands has also included in his patent a number of ingenious microphonic transmitters which are worthy of notice. These transmitters, we understand, Mr. Husbands claims to be clear of the Edison patent.

Both the transmitters and receivers described are very numerous, and we shall only refer to the principal ones.

Generally speaking, the transmitting instruments comprise a novel principle of construction; that is to say, the employment of a disc or diaphragm divided into, or consisting of plates, two of which form the terminals of the conducting wires, and which are enclosed within a chamber or recess filled, or partly filled, with coke or other suitable material in the form of fine or coarse powder, or in grains, lumps, or pieces of any convenient size and form. The said two plates or halves of the disc or diaphragm are formed of thin iron or other suitable material, and, when necessary, have an intermediate strip of non-conducting substance placed between, and connected with, them in any convenient manner. This simple and novel principle of construction may be embodied in numerous forms or modifications, all of which are highly efficient.

Fig. 1 is a transverse section of a transmitter, and fig. 2 a plan of the diaphragm of the same; *a*, *a*, are the two separate plates, halves, or parts of the disc; *b* is the insulating piece placed between them. The said two parts or halves *a*, *a*, of the disc or diaphragm are formed of thin iron or other suitable material and have the intermediate strip, *b*, of non-conducting substance connected with them in any convenient manner; on this diaphragm in the recess *c*, *c*, is placed the powdered coke.

It is not necessary that the disc be divided into two equal halves as shown in fig. 2, the halves may be, in fact, of any shape whatever or of any relative dimensions. Fig. 3 shows the disc divided into two portions insulated from each other, *a* forming one electrode and *b*, *b*, the other.

If the particles of coke be sufficiently large, it is not necessary that the separation between the two portions of the disc be closed by an insulating material, the use of the latter, in fact, being merely to prevent small particles from dropping through.

Fig. 4 shows an arrangement in which small spheres of coke are placed in a row along the separation between the two halves of the diaphragm disc.

Another modification of the transmitter is shown by figs. 5 and 6, it consists of a thin diaphragm, a^3, of vulcanite, mica, or other non-conducting material; through holes around the edge of this diaphragm are threaded or wound two pieces of wire, a^*, each extending nearly around one half of the circumference of the diaphragm and forming one of the electrodes or terminals of the conducting wires; the diaphragm thus constructed is placed in a suitable position in a box or case, *e*, having a chamber, c^3, in which the wire electrodes are placed and which is filled with granulated carbon or other suitable material. In some cases, the wire is replaced by corrugated or other strips of metal secured to the diaphragm. The wires may, if desired, be stitched into a diaphragm of cloth or leather (in such a manner as to form an equivalent for the two plates *a*, *a*,) near the centre thereof, the carbon being placed in the central chamber, *c*, of the box or case.

Mr. Husbands claims that in his split diaphragm transmitters he "breaks" the Edison transmitter "as specifically set forth," inasmuch as a diaphragm in combination with a tension-regulator as shown, cannot be made from his patent specification in the Edison form, nor the Edison form be made into his. Also in fig. 6 a diaphragm is used which Edison has disclaimed, and Mr. Husbands therefore considers that carbon can be used in it with impunity. A great advantage in the new transmitters is that they do not require any adjustment, whilst they are very simple and easy to manufacture.

We now come to the receiving apparatus. The improvements in this comprise a principle of construction wherein is used, in combination with magnets and a diaphragm, an intermediate piece which has an angular connection with the diaphragm.

Fig. 7 represents one form of the instrument; *f*, *f* are the electro-magnets; *g* is a disc or plate of thin mica, metal, or other suitable material; *h* is the intermediate piece attached to the said disc and projecting therefrom over the poles of the electro-magnets; *i* is a regulating screw for adjusting the pressure of the piece, *h*, upon the magnet pole with which it is in contact. It will be observed that the piece or armature, *h* (which is a thin tongue, strip or wire of magnetic substance, or of elastic material having a piece of magnetic substance attached to it), is held in contact with one pole of the magnet; therefore this armature will vibrate freely under the influence of an undulating or fluctuating current passing through the wire coils, and will transmit its vibrations mechanically to the disc, *g*.

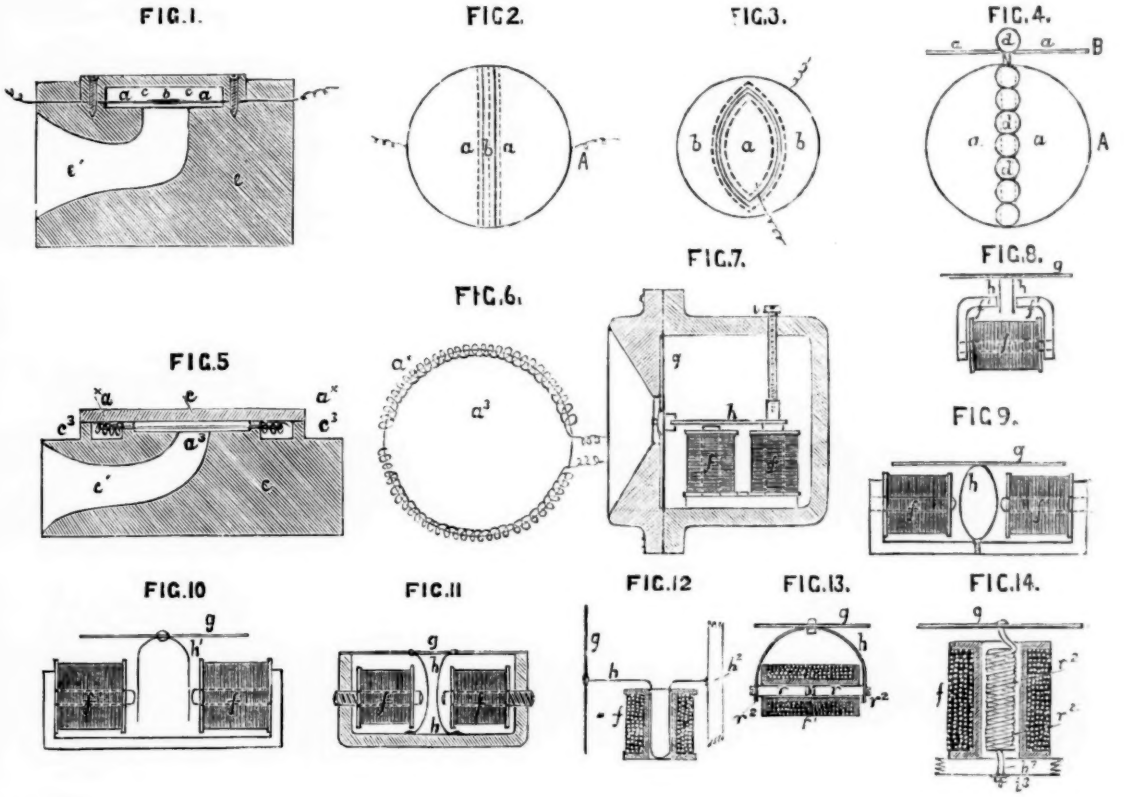
In the modification shown in fig. 8, two tongues or armatures are employed, and are caused to vibrate in opposite

directions by the fluctuations or variations of the current in the coils of the electro-magnet.

In fig. 9, the armature, *h*, is an elastic hoop of metal attached to the disc, *g*, and set between the poles of the magnets, *f*. It is obvious that this elastic armature will vibrate freely with, and according to, the variations of the current in the magnet coils, and will impart its vibrations to the disc, *g*, of the receiver. Figs. 10 and 11 show further modifications, which do not require explanation.

In fig. 12, the armature, *h*, is attached to the diaphragm, *g*, and extends at right angles from it to the point, h^2, of the case, where it is also fixed in any suitable manner; it will be seen that the armature is bent and extends down within a hollow electro-magnet or solenoid.

In the instrument shown in fig. 13, *h* is a semi-circular magnetic or non-magnetic elastic strip holding the parts, *r*, of the core in elastic suspension and attached at its middle point to the diaphragm, *g*. The parts, *r*, of the core are inserted in each end of the electro-magnet, *f*, so that there inner ends nearly touch one another. This



form of instrument can be greatly modified and applied to all forms of cores where a tongue, reed, loop, or other projecting part causes vibrations in the diaphragm, as the attraction between the two inner points at r^1 is greater, when operating within the influence of the coil, than that upon armatures attracted at the points r^2, r^2. These forms of receiving instruments may serve as transmitters. An additional advantage is that non-metallic tongues or strips can be used in the place of magnetic tongues or strips, the parts of the core attracting each other instead of attracting an armature. These cores can be made of a number of wires or pieces held together and forming a number of miniature magnets, or the core may be split into two or more pieces lengthwise, either wholly or partially. By placing iron filings between the cores, the transmitting efficiency of these instruments may be increased. If used as a transmitter alone carbon may be employed between the cores at the point r^1.

Fig. 14 shows an instrument in which there are a number of pieces of iron, r^2, acting as magnets and held in position within the coil, *f*, by means of the spiral wire, h^1, the adjustment of which, by means of the nuts, r^3, places the magnets in proper relation to each other. It is necessary for the spiral coil, which may be made of an elastic material, to extend beyond the core itself. A brass adjusting screw may be inserted in the end piece of the magnet either through the magnet or the case or both. By this means a proper adjustment of the magnets is obtained.

It is obvious that the end of the spiral instead of being connected direct to the diaphragm may be connected to the latter by an intermediate link, or two spirals may be connected to a hoop as in fig. 9.

It will be seen that in the instruments described there are several novel features, and, in the inventor's words, they demonstrate to a nicety that it is the "*wiggle*," so to speak, that reproduces speech, and the efficiency of receiving telephones is simply a matter of the degree of the wiggle imparted to it by the electrical variations of the current. The phonograph illustrates this in having its needle trembling or wiggling by the miniature cam-shaped indentures moving its point. Were it necessary, a cam of a shape corresponding to the fluctuations of the current for a given sentence could be made to reproduce speech with the inventor's instrument by the turning of a crank; and the speech would be machine made, the electrical current being used as a motive force or power, by which it is automatically converted into sound by means of the diaphragm. This principle, says the inventor, might be called the electro-mechanical phonograph, which is automatically operated from a distant point. By the invention, the core being divided or split, a non-metallic arm supersedes a magnetic armature. Almost any of the mechanical motions can be applied, it being a matter of degree only.

In fig. 12 the inventor points out there is a Reis needle, *that is not one*, the magnetic strip not passing through, but dipping into and leaving the coil at the same end at which it enters. The various classes of instruments are efficient as transmitters, as well as receivers, notwithstanding that the parts are out of circuit.

All of these novelties have produced practical instruments at a low cost, the inventor's aim being to do away with expensive parts, it being an object to make an automatic non-adjustable set of instruments which can be sold in a compact form to the consumer complete with all modern improvements, including call-bell, for £1, at the same time furnishing a handsome profit to inventor and manufacturer.

CALLENDER'S PATENT VULCANISED BITUMEN CORE.

THE following tables of electrical tests on samples of this core, which we have on several occasions spoken well of, have been submitted to us by Mr. Basil Gee, the electrician to Callender's Company. Our readers can now form their own judgment upon at least the electrical conditions of this insulating material.

ERITH WORKS, JANUARY 23RD, 1883.

1.—CORE COVERED OCTOBER 1st, 1882.

Length in Miles.	Conductor. No. of Wires.	Conductor. Size B.W.G.	Copper Resistance. Five Cells. Ohms. Observed.	Copper Resistance. Five Cells. Ohms. Per mile.	Copper Resistance. Five Cells. Ohms. 60° Fht.	Total external diameter. Inches.	Minute.	Dielectric Resistance.—150 Cells. Megohms. Zinc to Line. d.	Zinc to Line. Abs.	Zinc to Line. Pr. mile	Zinc to Line. 60° Fht.	Copper to Line. d.	Copper to Line. Abs.	Copper to Line. Pr. mile	Copper to Line. 60° Fht.	Inductive capacity per mile. M'farads.	Temperature, Fahrenheit.
·922	1	16	12·50	13·558	14·050	·26	1	142-2	948	874	162	142-2	948	874	162	·305	43°
							2	120	...	...	...	121	...	...	...	...	...
							3	112	...	...	...	111	...	...	...	...	...
							4	105	...	...	...	104	...	...	...	...	...
							5	101-1	1328	1224	...	101-1	1328	1224	...	...	...
					Earth reading		1	43	...	...	...	43	...	...	...	...	...
							2	22	...	...	...	23	...	...	...	...	...
					Current reversed		1	159	...	...	...	160	...	...	...	...	...
							2	140	...	...	...	130	...	...	...	...	...

Co-efficient of Instrument, 132,780 megohms.
E. M. F. of battery, 200 volts.

Co-efficient obtained for temperature from two lengths ... ... 1 d. ·262 D. ·475; 2 d. ·050 D. ·190

2.—CORE COVERED OCTOBER 1st, 1882.

·526	7	22	4·81	9·144	9·477	·3	1	63-2	2177	1145	213	65-2	2108	1109	206	·312	43°
							2	56	...	...	...	56	...	...	...	...	...
							3	51	...	...	...	52	...	...	...	...	...
							4	48	...	...	...	49	...	...	...	...	...
							5	46-1	2951	1552	...	46-1	2951	1552	...	...	...
					Earth reading		1	19	...	...	...	19	...	...	...	...	...
							2	12	...	...	...	13	...	...	...	...	...
					Current reversed		1	73	...	...	...	75	...	...	...	...	...
							2	60	...	...	...	63	...	...	...	...	...

Co-efficient of Instrument, 132,780 megohms.
E. M. F. of Battery, 200 volts.

Co-efficient obtained for temperature from two lengths ... ... 1 d. ·262 D. ·475; 2 d. ·050 D. ·190

3.—CORE COVERED JANUARY 2nd, 1883.

·158	1	6	·228	1·443	1·488	·5	1	24	5950	940	212	24	5950	940	212	·412	45·5°
							2	20	...	...	...	20	...	...	...	...	...
							3	18	...	...	...	18	...	...	...	...	...
							4	17	...	...	...	17	...	...	...	...	...
							5	16	8925	1410	...	16	8925	1410	...	...	...
					Earth reading		1	8	...	...	...	8	...	...	...	...	...
							2	4·5	...	...	...	4·5	...	...	...	...	...
					Current reversed		1	28	...	...	...	28	...	...	...	...	...
							2	23	...	...	...	23	...	...	...	...	...

Co-efficient of Instrument, 142,800 megohms.

Co-efficient obtained for temperature from two lengths ... ... 1 d. ·262 D. ·475; 2 d. ·050 D. ·190

4.—CORE COVERED JANUARY 10th, 1883.

1·000	1	18	21·12	21·12	21·796	·200	1	131	1082	1082	217	132·5	1070	1070	215	·270	45°
							2	113	...	...	...	114	...	...	...	...	...
							3	106	...	...	...	107	...	...	...	...	...
							4	100	...	...	...	101·5	...	...	...	...	...
							5	96	1476	1476	...	97	1461	1461	...	...	...
					Earth reading		1	39	...	...	...	38	...	...	...	...	...
							2	...	...	...	...	25	...	...	...	...	...
					Current reversed		1	149	...	...	...	150	...	...	...	...	...
							2	128	...	...	...	129	...	...	...	...	...

Co-efficient of Instrument, 141,720 megohms.

Co-efficient obtained for temperature from two lengths ... ... 1 d. ·262 D. ·475; 2 d. ·050 D. ·190

* The Co-efficient for temperature has not yet been accurately determined, and is therefore only approximate.

ELECTRICAL ENGINEERING AT MASSACHUSETTS.

On several occasions we have called attention to the methods adopted by the technical institutes in London in regard to instruction in electrical engineering, and on this subject we learn that the Massachusetts Institute of Technology has established a four years' course, the details of which will be of interest to many of our readers. The corporation of the institute say that in view of the rapidly increasing development of the various branches of electrical engineering, and the consequent demand for persons conversant with the theory and applications of electricity, they have established a course of instruction bearing more directly upon this subject than any of those which have hitherto been offered to the student. This has been done by establishing an alternative course in physics, which differs from the previous course chiefly in the continued study of electricity, instead of the pursuit of other branches of physics, and in the introduction of a considerable amount of practice in the laboratory of mechanical engineering and the workshops in place of chemical analysis. An endeavour is made to give to students pursuing this course a knowledge of the theory of electricity sufficiently extensive to prepare them for all ordinary electrical work, and to also serve as a foundation for more advanced study. They receive instruction in the physical laboratory in the various methods of electrical testing. Special instruction regarding land and submarine telegraphy, the telephone, electric lighting, and the electrical transmission of power is given, and the study of acoustics is also acquired in view of the art of telephony.

The nature of the course is as follows:—

First Year.

First Term.—Algebra; solid geometry; general chemistry; chemical laboratory; rhetoric; English composition; French; mechanical drawing; free hand drawing; military drill.

Second Term.—Plane and spherical trigonometry; general chemistry; qualitative analysis; chemical laboratory; English history: English literature; French; mechanical drawing; free hand drawing; military drill.

Second Year.

First Term.—Physics, lectures; physical laboratory, general laboratory work, and experimental acoustics; analytic geometry; descriptive geometry; shopwork, carpentry; wood and metal turning; descriptive astronomy; English history and literature; German; machine drawing.

Second Term.—Physics, lectures; physical laboratory, general laboratory work, acoustics, simple applications of electricity; differential calculus; shopwork; wood and metal turning; physical geography; English history and literature; German; general physics, theoretical, acoustics; machine drawing.

Third Year.

First Term.—Physical laboratory, special methods in photometry; general physics, electricity, photometry; integral calculus; applied mechanics; mechanical engineering, theory and practice of steam and other engines; mechanical laboratory, use of dynamometers, indicators, &c.; constitutional history; German.

Second Term.—Physical laboratory, electrical measurements and testing; general physics, electricity; advanced physics, memoirs, &c.; history of physical sciences; applied mechanics; mechanical engineering; mechanical laboratory; political economy; German.

Fourth Year.

Physical laboratory, electrical testing and construction of instruments; general physics, applications to telegraph, telephone, electric lighting, &c.; photography; history of physical science; mechanical engineering laboratory; applied mechanics, thermodynamics, hydraulics, &c.; physical research; general physics, applications of electricity; advanced physics, memoirs, &c.; principles of scientific investigation; advanced mathematics.

Note.—The student is advised to take Advanced German.

During the second year the whole subject is discussed in a series of lectures which are attended by all the regular students. The various branches are treated both mathematically and experimentally. In all cases the theoretical discussion of a question is followed by a full account of its practical applications. The institute possesses an extensive and constantly increasing collection of physical apparatus. In the third year the student enters the *Rogers Laboratory of Physics*, learns to use various instruments for physical measurement, and verifies many of the fundamental laws of nature. The experiments are so chosen that some of them —for instance, those with the microscope and spectroscope— have a direct technical value; others are intended to establish certain principles in the mind; to cultivate manual skill in handling minute or delicate objects, or to exercise the reasoning faculties, and show how to apply mathematics to concrete problems. Thus the course has a value beyond the immediate aim of the experiments in the direction of general culture, teaching the student to derive conclusions from observed facts, and showing him various methods of experimental research. In the fourth year a portion of the students carry on work of a more technical nature. Original investigation is stimulated as far as possible, and the result has been a considerable number of published memoirs. On alternate years a course of lectures will be given upon the scientific principles involved in the more recent applications of electricity, including the telegraph, the telephone, electric lighting, and the transmission of power by electricity. Candidates for a degree in physics pursue the following courses:—Microscopy: Theory of the microscope, application to study of various objects, test-objects, modes of illumination, applications of polarised light, use of micro-spectroscope, measurement with different forms of micrometer, focal length and angular aperture of objectives, preparation of objects. Photography: Methods of photography and its connection with lithography and printing, preparation of baths, taking glass negatives, lantern slides, paper positives; photographs of microscopic objects, of spectra, &c. Lantern projections: Sunlight, lime, magnesium, and electrical lights; lanterns, condensers, and projecting lenses; projection of views, and of real objects; tanks, chemical and electric decompositions; projection of spectra. Meteorology: Atmospheric temperature, pressure, and moisture; velocity of the wind; magnetic elements; electricity of the air. In addition to the laboratory work, students in this department receive instruction in general physics throughout the third and fourth years, and gain a familiarity with standard works on various branches of the subject, both in their own and in foreign languages. Advanced Physics: As many of the students taking the course in physics intend to make teaching their profession, a special course is prepared with this object in view, in which each student in turn prepares a particular subject, giving the result of his own or other researches, and presents it in the form of a scientific memoir or lecture. Teachers of physics, and others properly qualified, may enter the laboratory, and take the whole or any part of the above courses. An alternative course in physics has recently been established for the benefit of students wishing to enter upon any of the branches of electrical engineering. In this course especial instruction will be given concerning the various practical applications of electricity to land and submarine telegraphy, the telephone, electric lighting, and the electrical transmission of power. An extended course of laboratory instruction in electrical measurements will also be provided. *The Instruction in Theoretical and Applied Mechanics:* This instruction, which is given to all regular students of the courses of engineering and architecture, is begun about December 1st of the third year. During the third year the subjects studied are the composition and resolution of forces, the general laws of kinematics and dynamics mathematically discussed, the principles governing the determination of the stresses in the different members of trusses, centre of gravity, moment of inertia, and the ordinary principles of the strength of materials, this latter subject occupying fully half the time devoted to applied mechanics in the third year, and being subsequently completed in the fourth year. In this course the methods of the differential and integral calculus are freely used whenever they are the most convenient. In the fourth year's classes the subjects pursued by the students of each professional course are arranged with reference to the special wants of that course, and then two or more classes are taught together whenever the instruction to be given covers the same ground. This instruction embraces the completion of the study of strength of materials, including laboratory work; theory of elasticity; main principles of the stability of arches and domes; hydraulics, thermodynamics, and special study of dynamics.

Among the officers of instruction of the institution, are Mr. Charles R. Cross, S.B., Thayer Professor of Physics; Mr. Silas W. Holman, S.B., Assistant Professor of Physics; and Mr. Wm. H. Pickering, S.B., Assistant in Physics. And among the graduates are, in 1869, Mr. J. Rayner Edmands, Cambridge, Mass., course 2, charge of Time Service at the Observatory of Harvard University: in 1870, Mr. Charles

R. Cross, Sci. and Lit., Boston, Mass., Professor of Physics, Mass. Insti ute of Technology: in 1873, Mr. George W. Blodgett, Boston, Mass., course 1, Manufacturing Electrician and Electrician B. & A. R. R.; and Mr. Frank W. Very, Allegheny Pa., course 5, Assistant Astronomer, Allegheny Observatory: in 1876, Mr. Aaron D. Blodgett, Boston, Mass., course 2, Electrician; Mr. John B. Henck, Jr., London, Eng., course 8, in telephone business; Mr. Silas W. Holman, Boston, Mass., course 8, Assistant Professor of Physics, Mass. Institute of Technology; and Mr. William W. Jacques, Boston, Mass., course 8, Electrician of the American Bell Telephone Co.: and in 1882, Mr. George W. Mansfield, Greenville, N. J., course 3, Chemist Daft Electric Light Co.; and Mr. Anthony C. White, Boston, Mass., course 8, Assistant Electrician New England Weston Electric Light Co.

THEORY OF MAGNETISM.*

IN the year 1879† I communicated to the Royal Society a paper "On an Induction Currents Balance and Experimental Researches made therewith." I continued my researches into the molecular construction of metallic bodies, and communicated the results then obtained in three separate papers‡ bearing upon molecular magnetism.

To investigate the molecular construction of magnets required again special forms of apparatus, and I have since been engaged upon these, and the researches which they have enabled me to follow.

From numerous researches I have gradually formed a theory of magnetism entirely based upon experimental results, and these have led me to the following conclusions:—

1. That each molecule of a piece of iron, steel, or other magnetic metal is a separate and independent magnet, having its two poles and distribution of magnetic polarity exactly the same as its total evident magnetism when noticed upon a steel bar-magnet.

2. That each molecule, or its polarity, can be rotated in either direction upon its axis by torsion, stress, or by physical forces such as magnetism and electricity.

3. That the inherent polarity or magnetism of each molecule is a constant quantity like gravity; that it can neither be augmented nor destroyed.

4. That when we have external neutrality, or no apparent magnetism, the molecules, or their polarities, arrange themselves so as to satisfy their mutual attraction by the shortest path, and thus form a complete closed circuit of attraction.

5. That when magnetism becomes evident, the molecules or their polarities have all rotated symmetrically in a given direction, producing a north pole if rotated in this direction as regards the piece of steel, or a south pole if rotated in the opposite direction. Also, that in evident magnetism, we have still a symmetrical arrangement, but one whose circles of attraction are not completed except through an external armature joining both poles.

The experimental evidences of the above theory are extremely numerous, and appear so conclusive, that I have ventured upon formulating the results in the above theory.

I hope in a few weeks to bring before the Royal Society the experimental evidence which has led me to the conclusions I have named; conclusions which have not been arrived at hastily, but from a long series of research upon the molecular construction of magnetism now extending over several years.

Reduction of Telegraph Rates in America.—We notice the following in the *New York Evening Post* of the 19th ult.:—On January 20th the Western Union Telegraph Company will make 25 cents its maximum rate for a message of ten words between any of its offices in New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York City, and the South-Eastern part of the State of Maine. Orders were given to reduce the present rates of 30, 35, 40, and 50 cents to the 25 cent rate.

* "Preliminary Note on a Theory of Magnetism based upon New Experimental Researches." By Prof. D. E. Hughes, F.R.S.

† "Proc. Roy. Soc.," vol. xxix., p. 56, 1879.

‡ "Proc. Roy. Soc.," vol. xxxi., p. 525; vol. xxxii., pp. 25, 213, 1881.

BENNETT'S INSULATOR.

ONE form of this insulator (the design of Mr. A. R. Bennett, of Glasgow) is shown by figure 1. The invention was adopted by him about a year ago, in the construction of the telephonic lines of the National Telephone Company, Limited, by Messrs. D. and G. Graham, of Glasgow. Prior to the introduction of these insulators it had been the universal practice, in Great Britain, at all events, to insulate over-house telephonic wires by means of double-shackles, *i.e.*, two shackle-cup insulators fastened to the pole or other support by means of four galvanised iron straps and three galvanised iron bolts and nuts. This was done owing to the desirability of confining the effects of a rupture of the wire to the span on which it occurred, and also of preventing the wire falling into the street in case of the breaking of an insulator. The wires were consequently terminated in the well-known manner round a Bright's shackle-cup at every support, and were joined through to

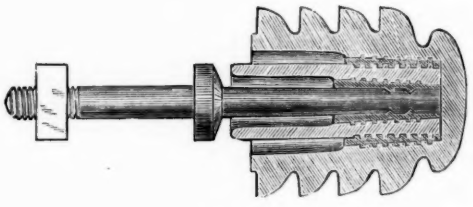


FIG. 1.

the next spans by short cross-connections or jumpers. But the mechanical advantages of the shackle obtain to a great extent at the expense of the electrical. At each cup the current has two paths to earth, which, everything else being equal, would, by the law of derived circuits, reduce the insulating efficiency of the single-shackle to one-fourth of that of an upright insulator, and of the double-shackle to one-eighth. But in practice, especially in wet weather, the proportion in favour of the upright, even if only a single-shed, is very much increased, as the shackle has no inner cup, and no part of it can be kept even approximately dry. A good double-shed upright probably insulates thirty times better than the double-shackle, its large effective dry surface being wholly, in addition to the gain of eight times, derived from the position of the wire at its summit, and the existence of only one path to the bolt. Mr. Bennett's attention was directed to the bad insulation

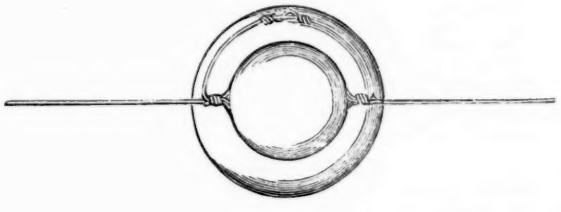


FIG. 2.

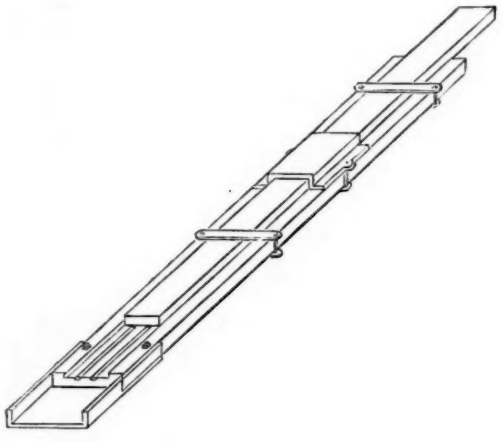
of telephonic wires constructed on the old plan by the frequent occurrence of overhearing on comparatively short lines. This was popularly attributed to the effect of induction, but by substituting upright insulators for the double-shackles, the disturbance was either cured entirely or perceptibly diminished.

The so-called induction was, therefore, proved to have been, in part at least, actual current leakage. So far so good; but it would not do to use ordinary upright insulators for overhouse work. Something to fulfil the mechanical function of the shackle was required, so Mr. Bennett designed, early in 1882, the form of insulator shown by fig. 1, and also a similar form without the inner cup. They are used in precisely the same way as shackles, each span being terminated round the insulator, and joined through to the next by a soldered cross-connection (fig. 2). When light wire, such as Nos. 16 to 20 phosphor bronze, is employed, both spans are terminated round the topmost corrugation.

With heavier wire it is better to terminate each span in different corrugations, preferably the first and second from the top. When unusually long spans are necessary it is well to reduce leverage by using the second and third, or even the third and fourth corrugations, the insulation under these circumstances, owing to the dry cup, still being far superior to anything obtainable from shackles. The terminating of the wires round the lower corrugations is also advisable when a support happens to be placed much below the level of those on each side of it. The breakage of a span does not consequently affect the neighbouring ones, while the extension of the bolt into the head of the insulator prevents the fall of the wire into the street when an insulator breaks. Besides admitting of the spans being terminated, the four corrugations increase the insulating surface considerably, and give the insulator a very ornamental appearance. The single-shed is intended for use on wires of moderate length. The double-shed shown in the figure possesses a high insulating efficiency, is very substantial, and is well adapted for long telegraph lines and for carrying heavy electric-lighting conductors.

TEMPLE'S PATENT SLATE INSULATION FOR ELECTRICAL CONDUCTORS.

THIS insulation, the invention of Mr. W. J. Temple, of Canon's Marsh, Bristol, consists of lengths of slate in two layers, the lower one grooved to receive one or any number of wires or conductors. The general arrangement is shown by the figure. The two pieces of slate have their surfaces



planed perfectly true so as to fit closely together ; they are secured by brass cramps. The advantages claimed by the inventor are :—

Perfect insulation, allowing the use of bare conductors.

Freedom of access to conductors at any time for examination, testing, &c.

Its permanency and moderate cost. The simplicity and despatch with which it can be laid, and the ease with which branches can be added at any point, and at any time.

With the exception of the first point Mr. Temple's invention possesses, we think, what is claimed for it, but we doubt whether the inventor can have any idea of what is meant by "perfect," or anything like perfect, insulation. None but those who have had considerable practical experience in underground or submarine cable work can have any idea of the difficulties which exist in obtaining even moderate insulation of wires. The number of attempts which have been made to insulate wires, on a similar principle to that advocated by Mr. Temple, have been very numerous, but in every case (without a single exception, we believe) complete eventual failure has been the result.

It is an axiom with those who know the conditions required for underground insulation that where air can percolate, moisture will creep in ; and it is astonishing with what facility moisture will penetrate through the most minute crevices, and when once the smallest amount of moisture enters the working condition of a wire is practically destroyed. This applies equally with the electric light as with the telegraph and telephone. The numerous failures to devise a satisfactory new system of underground work have almost always arisen from ignorance of the conditions necessary to obtain success. The mechanical engineer has attempted to do the electrician's work, or, at least, to do it without the help and advice of the electrician. Under these circumstances failure is almost always certain.

LEGAL.

The United Telephone Co. v. Harrison, Cox-Walker & Co.

THE hearing of this appeal, which is by the defendants, Messrs. Harrison, Cox-Walker and Company from so much of the judgment of Mr. Justice Fry as held the telephone receivers manufactured by them to be an infringement of Prof. Graham Bell's patent of 1876, was again resumed before the Master of the Rolls and Lords Justices Lindley and Bowen, in the Court of Appeal of the High Court of Justice, on Friday of last week.

Mr. Hemming, Q.C., and Mr. Goodeve, as before, appeared for the appellants, the defendants in the recent action, and Mr. Aston, Q.C., Mr. Webster, Q.C., and Mr. Moulton for the respondents, the plaintiffs in the action.

Mr. Aston, continuing his arguments for the respondent company, submitted that the receiver in question was not to be considered as part of a complete instrument but as a receiver, and therefore, although it was true it was to be used in connection with other instruments, it was so far complete in itself that he asked the court to consider it as a complete instrument.

The Master of the Rolls : Oh, but it is not a complete instrument, it is only a part of an instrument, and what is the use of asking us to consider it a complete instrument ?

Mr. Aston : I submit it should be so considered.

The Master of the Rolls : But it cannot be considered as an independent instrument, so there is no use arguing that it can. I am not at all anxious to decide against you ; but a great inventor is not to be defeated lightly on mere technicalities.

Mr. Aston contended that his clients' complete instrument was better than that shown at Glasgow, and he asked their lordships not to allow, as had been done in the experiments made to the court, the light of 1882 and 1883 to be applied to the Glasgow receiver—not to allow it to be used in a different way to that contemplated, as Sir William Thomson told them, both by the inventor, Prof. Bell, and Sir William Thomson. The Glasgow instrument, he submitted, was in an experimental stage, and there was nothing done, or said, or shown at Glasgow to defeat a subsequent patent. Besides, he maintained that the instrument described in the specification as a receiver was superior to, and an improvement on, that shown at Glasgow. Witness after witness had stated that as compared with the Glasgow instrument, the Bell receiver was an improvement, and therefore even if their lordships should be against him in his contention that the Glasgow receiver never went beyond the stage of experiment, but held that on the other hand it was, to a certain extent, practically useful, he relied on his next contention that putting aside all that was done, said, or shown at Glasgow, there was sufficient difference and improvement in his clients' instrument as compared with that shown at Glasgow to constitute a good patent, and therefore the judgment of the court below ought to be supported. As regarded the tilt, their witnesses thought it was intentional ; it never occurred to them that it was not, and the burden of showing that the tilting would have been corrected lay, he argued, with the appellants.

Mr. Webster, also for the appellants, argued that it required positive invention to do that which now appeared to be so simple, using the disc flat on the magnet instead of as a vibrating tongue, and asserted that Prof. Bell, between August, 1876, and December, 1876, was going through a course of invention in regard to that matter. In no single case could it be pretended that Prof. Bell intended his instruments to act as reeds. Sir William Thomson, in his evidence, said confidently that he thought the tilting up of the disc of the Glasgow instrumant was intentional.

The Master of the Rolls distrusted the recollection of Sir William Thomson in 1882 of what he saw in 1876, because, as he read his evidence, he thought there was a tilting up of the Philadelphia instrument, which was a mistake.

Mr. Webster held that the most competent electrician, never having been at Philadelphia, having the Glasgow instrument before him would have believed that under no circumstances should the disc have touched the magnet ; and in the disc touching the magnet lay the marvellous discovery of Prof. Bell. From the beginning to the end of the arguments in the court below it was never suggested that Prof. Bell's receiver was not a better receiver than the Glasgow one, and, fundamentally, he contended it was utterly different.

The court adjourned, and

At Saturday's sitting experiments were tried at the instance of the respondents—the plaintiffs in the action—the instruments used being fitted with magnets and plates taken from instruments handed over by the defendants to the plaintiffs under the injunction granted by the court below. It was proposed, first, to test the instruments with circular discs and frames, the one instrument used as a transmitter and the other as a receiver, and then to use the same instrument as a transmitter acting upon the Glasgow instrument as a receiver. The instrument thus tried was

said to be not in the improved form in which Prof. Bell's telephones were now made, but according to the figure shown in the specification.

Mr. Hemming (for the appellants) objected that the mounting differed from the figure in the fastening of the metal disc to the frame by four screws instead of two, and also in the thickness of the wood frame to which the disc was attached.

The Master of the Rolls could not suppose that the thickness of the wood would affect the action of the instrument, and as to the screws the receiver could be tried both with four screws and with two.

The experiments were then proceeded with, the battery and transmitter being located in an adjoining room, and the receiver being placed near to the judges so that it could be passed from one to another. The Master of the Rolls, placing the receiver close to his ear, announced that he could hear that speaking was going on, but he could not distinguish any words. Mr. Aston, Q.C., next took the receiver and heard the words, "Every day, young man," but lost the remainder of the sentence. Mr. Webster, Q.C., premising that his hearing was more than ordinarily acute, next listened and was able to catch the words, "And everywhere that Mary went the lamb was sure to go," and "Hey diddle-diddle, the cat and the fiddle." Mr. Hemming, Q.C., suggested that it would be better that the transmitter should read from a newspaper rather than recite familiar rhymes, and the objection being considered reasonable a series of figures were given out in irregular order and correctly repeated by Mr. Webster. The same transmitter was next tested with the same battery in connection with the Glasgow receiver, and while the disc remained tilted up the Master of the Rolls could hear nothing at all. Lord Justice Bowen, however, caught a faint sound though unable to catch a single word. With the disc pressed down to the rim the Master of the Rolls heard a "rumble" and Lord Justice Bowen made out something approaching articulation. To the specification figure receiver a good Bell transmitter was then attached, and their lordships could hear most distinctly, and the same transmitter being tried with the Glasgow receiver the Master of the Rolls again heard a rumbling sound, but Lord Justice Bowen was able to make out some words read from a newspaper.

Mr. Webster submitted that the experiments had established that a receiver according to the drawing in Bell's specification would speak better than the Glasgow instrument, and that even with the improved transmitter used for both it was a better receiver than that which was shown at Glasgow, and could be sold for one-fourth the cost.

Mr. Webster having concluded his arguments the court adjourned.

The court resumed on Monday, when—

Mr. Hemming, replying on behalf of the appellants, said he was of opinion that the essence of the case was to be found in the construction of the specification. It was not disputed that there was one natural construction to be put upon the first claiming clause. It had no ambiguity about it, and he objected to the opposition counsel twisting the words of the clause to show it claimed something it did not. The law as to "benevolence" as to patents had never gone so far in any reported cases as to say that when the wording of a claim was perfectly natural and easy of construction, something entirely immaterial could be included in the clause. The learned counsel on the other side had tried to drag in imaginary ideas which were never in the inventor's mind when the specification was drawn up. Something was claimed as an invention which was certainly not in the specification.

The court again adjourned.

The court resumed on Tuesday morning, when various experiments were made in support of the appellants' contention that the instrument exhibited at Glasgow would answer its purpose if the metal disc were kept pressed down on the frame of the cylinder.

Mr. Hemming then said he thought he might take the result of the experiments to be that with a Humning's transmitter every receiver speaks, and most of them exceedingly well.

The Master of the Rolls: Yes.

Mr. Hemming: But that with transmitters that were known at the time of the Bell patent being taken out, and with the transmitter described in the Bell patent, none of them would speak without considerable difficulty. He submitted that the evidence given by the defendants' witnesses at the trial went to establish that any competent person who saw the instrument exhibited at Glasgow, unless he saw the disc crumpled upwards, would have come to the conclusion that the disc was meant to go down in action. The Glasgow instrument had become public property, he submitted, and when an instrument became public property, the public might, notwithstanding any patent in the world, use it at any time they liked. Therefore the Glasgow instrument might be used by anybody with the lid down. Again, whether the alleged invention was anticipated or not, he held there was not a sufficient description of it in the specification.

Mr. Hemming having concluded his reply,

The Master of the Rolls delivered his judgment. He said the appeal was from the decision of Mr. Justice Fry, who found in favour of the plaintiffs with reference to the infringement of a portion of a patent. The portion referred to was the receiver in Bell's patent. Before proceeding further with his judgment he wished to say that in his opinion the case had been elaborately and remarkably well argued on both sides. If he had any complaint at all, and a complaint perhaps he ought not to make in a case of this kind where he had derived so much assistance from the bar on the subject, it was that perhaps the arguments might have been compressed. Subject to that observation, he had only to thank the bar for the great advantage he had derived from their arguments and for the information afforded him. The patent was admittedly one of great merit; it was one of the most important and remarkable inventions of the century, and if it failed, as it might, it would be from some claim being too wide, or some description not sufficient. Now he had said on many occasions, and said again, that when they had an invention of great and acknowledged merit, it was the duty of the judges to read the words so far as they could consistently with rules of construction, so as to uphold the patent and not so as to defeat it, and that was all that he understood of what had been said so often about "the benevolent construction" put upon patents. The first objection raised on the part of the appellants was that they had not infringed at all. Now that depended on the mode in which they construed the specification. He did not understand that that point was made in the court below in that wide form, but he considered it to be very material. There were two portions alleged to have been infringed, the one the permanent magnet called the Hickley, and the other the electro-magnet called the Cox-Walker. As regarded the Hickley, he thought that it was so clear that it was not worth discussing. The suggestion made was that it was not an infringement because the defendants had bought it now and again from the makers, and were not persons who sold it regularly or were manufacturers. The defendants' prospectus or circular was put before them, and it was obvious from it that they did represent to the public that they were the manufacturers of the Hickley as well as of the Cox-Walker, and that they sold it as their own production. He thought, therefore, so far as regarded the Hickley receiver they had no ground whatever for complaint, and the infringement, as far as that was concerned, was perfectly plain. As regarded the last case, that was a case of infringement, depending no doubt on the reading of the specification. He was not going to say, and it was not his opinion, that that was anything but a difficult specification—difficult to consider even in the light of the knowledge they now possessed, and certainly it must have been extremely difficult at the time it was published, and when they knew little about the subject. The case was of very great importance, and if it was carried further he would be glad so far as he was concerned. He concurred entirely with the view of Mr. Justice Fry, that the instrument of Reis was not an anticipation of this instrument. The language of the specification evidently meant that the receiver and transmitter were the same, each having a similar steel plate and a similar motion. It also showed that the plate was in front of the magnet and not only in front of the magnet but attached. The drawing showed that it was attached by two buttons or screws. He could not imagine anybody having the right who would not attach it by at least two screws. He had no doubt any intelligent workman would fix it with at least two screwa. The question was did the defendants infringe? There was no doubt what they used was kept down by a screw in a similar way, in a similar position, and for the same purpose, and it was only trifling with words to say that was not substantially the same thing as that which the plaintiffs had described. Therefore on the question of infringement his opinion was quite as adverse to the defendants as far as regarded the Cox-Walker as it was as regarded the Hickley. Now they came to a different and difficult point. Assusming it was an infringement, was the plaintiffs' patented invention bad for want of novelty? Had it been previously published? The history of the case was simple. The patentee himself declared he made the invention—not the present invention, as it turned out, but a similar invention—not so perfect, but still he published it, and gave the instrument to Sir Wm. Thomson, who was to attend a meeting of the British Association at Glasgow for the purpose of publishing it to the world. Sir Wm. Thomson, who was a great electrician, was not, he thought, quite candid with that meeting of the British Association. Before the meeting he had tried to work the invention; he had tried to work it at Philadelphia, but could not make it work. He then made a speech to the British Association, in which he did not tell them he could not work it. He told them, no doubt, what was true, that he had seen something similar at work producing articulate sounds at Philadelphia, but he did not tell them he could not work the thing he had in his hand. He did not know how to work it, and he trumpeted it forth as a very great invention—one of those marvellous productions—a "new something" which would glorify Professor Bell to eternity. What was the position of matters? Somebody or other had told the mechanic who made the instrument handed to Sir Wm. Thomson, to put a screw on the top of the case which contained the magnet, and screw down the disc, and that this had been done purposely was obvious, for the place of the disc where the screw was put in jutted out from the case, and there was a hole made in it and the screw put in. Then somehow or other—he presumed by the shaking of Sir Wm. Thomson's portmanteau—when the machine got to Glasgow this thin disc, which was screwed to the case containing the magnet had got crumpled or creased, and the result was that instead of lying flat on the top of the case it was slightly raised so as to be tilted, and not to touch the case containing the magnet except at the point where it was fastened with the screw. Now when it was shown by Sir William Thomson to the meeting of the British Association, with a speech which as he read would have told him it would work and produce a marvellous result, everybody could see it was tilted. Nobody knew, as he understood the evidence—neither Sir William Thomson nor anybody else—how to work it. The state of knowledge, then, in regard to the transmission of sound, was such that nobody who saw it could have worked it, and nobody did work it. He agreed if they knew then what they know now, they would have understood the disc was to be flat, and that the current, if it was strong enough, would draw it down, but at that time nobody knew anything about these things. Nobody could correct it. Sir William Thomson stated he thought at the time that the crease, which he (the Master of the Rolls) was satisfied was done on purpose, was intentional, and was a part of the concern. That, however, was not material. He was satisfied there was no ordinary intelligent workman who would have made that thing in any other way than with a tilt. They had this corroboration: they had a description in the news-

papers which described it as not touching except at one point, and they had the drawing which showed it tilted. He was satisfied when it was shown at Glasgow that it was tilted, and what took place at Glasgow was the publication of what he would call the Glasgow uncorrected receiver. Was the invention afterwards patented the same receiver, or was it a different receiver? was it so different as to be capable of being sustained by a patent? They must first consider what was claimed, and that was the subsidiary part of a great invention. As he had always understood, very little would do to support a claim to a subsidiary part. Considering the merit of the invention they must consider it as a whole, and they did not require the same amount of merit to support the subsidiary claim which they did to support the entire invention which was the subject-matter. If they found that this thing which was the subject-matter of the subsidiary claim was not the same, and if there was some material difference possessing some real advantages it was then sufficient to make a good invention. They found that the invention differed from that shown at Glasgow. The disc was fastened by a different mode of attachment, and that difference of adjustment appeared to him to be material, and the evidence showed that when it was fastened with a screw the disc got crumpled or creased, whereas if it was fastened in the other way there was no such probability, which was an advantage. Then again, when they had a high resistance in the magnet the mode adopted by the patentee gave better results than the Glasgow receiver did. Another advantage was that Bell's instrument could certainly be used both as a receiver and transmitter; although the appellants had been invited to show them that they did not do so; and he was unable to dissent from the conclusion of the court below that it could not be so used. There were other points of difference, but they were very slight. In the last place, he could not but overrule the objection on the construction of the patent, that the first claim was too wide. On the whole he was not able to say that he differed from the learned judge of the court below, and he therefore dismissed the appeal with costs.

The court then adjourned, Lords Justices Lindley and Bowen announcing that they would deliver their judgments on the following morning, but they intimated that they agreed with the judgment of the Master of the Rolls.

On the court again meeting on Wednesday,

Lord Justice Lindley, after describing the character of Prof. Bell's invention and his discoveries, said it appeared to him that Prof. Bell's discovery that the same instrument would act both as a transmitter and a receiver was described with sufficient clearness in the specification. Looking back to Reis's instrument, it seemed to him plain, and he thought the witnesses showed that, that Bell's invention was immensely in advance of Reis's; and in his opinion it could not be said Reis's was an anticipation of Bell's. The evidence clearly showed that the disc of the Glasgow receiver was tilted up, and it was impossible to say that it was the same as Bell's instrument. Mr. Hemming's criticisms on the specification did not drive him to the conclusion that there had been no infringement. The conclusion he had come to was that the specification was good, and that the infringement was proved.

Lord Justice Bowen also delivered judgment, agreeing with both the Master of the Rolls and Lord Justice Lindley.

Electricity and Fire Damp.—The properties of electricity are explained in an entirely novel and amusing way by Mr. William Brown, of Glasgow, whose views, like those who believe in the attainment of perpetual motion in mechanics, are diametrically opposed to those of men who have investigated the subject. He, of course, shows that Prof. Silvanus Thompson's conclusions are all erroneous, and that the magnetic needle has been going the wrong way for the last 500 years. The Professor states that a dry warm glass tube, excited by rubbing it briskly with a silk handkerchief, will attract strongly a pith ball hung up by a fine thread from a support, showing that it is highly electrified. Mr. Brown states that this fallacy of substituting the rod that is electrified for the one out of which the electricity has been rubbed, runs through the whole of the Professor's books, and is the leading principle on which he founds all his experiments and from which he draws all his conclusions, and being founded on a fallacy, the whole is wrong. But Mr. Brown's notions about fire-damp are still more extraordinary. Fire-damp, as it is called, may, he admits, be partly hydrogen gas, but a more careful investigation may show that it is composed principally of electricity, and that it might be carried off to the well or sink at the bottom of the shaft on the principle of the lightning rod conductor, or converted into light for the benefit of the miners. A well-ventilated mine has, he says, been known to give off 900,000 cubic feet of explosive gas in five minutes, and he stated that from experience it has been found that the best thing that can be done to a man rendered insensible by it is to bury him in the earth for a time, adding that this custom can be understood if it is meant by it to extract electricity out of his body by placing him in a good conducting material, but in no other way.—*The Mining Journal.*

TO CORRESPONDENTS.

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CORRESPONDENCE.

Electric Lighting in Sheffield.

In Mr. Conrad Cooke's report of the above in your journal of last week, I fail to find reference made, under any heading, to the first cost or more particularly the *renewal* of the incandescent lamps.

Taking his own figures of their estimated life and the average hours in use as 1,000 and 1,500 hours respectively, and the cost of the Swan lamp at, say, 4s., or the Edison at 3s. each only for 10,000 lamps, there has to be added to the annual maintenance an *item* of £3,000 on the former and £2,250 on the latter system!

The working cost for 3,000 hours is brought out at 18s. 6d. per lamp, with coal at 7s. per ton. In London coal would at least be double this price, and, according to Mr. Cooke's estimate for coal, &c., under Production (I), this sum would approximately reach 21s. 6d., and with 6s. added for renewals, 27s. 6d. per lamp.

Now as to competition with gas, to put it in a *practical* form, take the lighting of my own small residence, the difference in cost would be as follows: five lights (electric) would thus amount to £6 17s. 6d. per annum, whereas my five gas burners cost me considerably less than £4 for the year, and are *always* available.

This would appear to bear out Dr. Siemens' view of the matter in his recent lecture given at the Society of Arts, viz., that this "light of the future" will be for years to come a light of *luxury*.

I note that Mr. J. N. Shoolbred has, curiously enough, made a similar omission in his estimates for the lighting of the Newington district, the cost of the renewals of the lamps being entirely ignored.

Theoretical Cost!

February 6th, 1883.

Electrical Accumulators.

It is a pleasure to be able to record that, as a rule, we have received nothing but courtesy and cordial support from the leading electricians of this country in connection with the important and interesting, but somewhat difficult, work we have undertaken in the introduction of electric accumulators; it is, therefore, with regret that we find any one

adopting a tone of ill-will such as is evident in the letter of "E" in your issue of Jan. 27th.

We have rectified the omission of the word "hours" after "ampères" in certain places. In practical working, however, for some time past the word "hours" has been omitted as being well understood, and there is little cause to cavil at its omission.

The very basis of "E's" calculation in the second paragraph of his letter is entirely wrong, and he is consequently led astray. The internal resistance of each of our cells is not ·0125 ohm, as he assumes, but ·003. This proves the accuracy of our statement as to loss between charge and discharge.

We give the maximum charge of a 1 E. H. P. cell as 400 ampère-hours. If 300 be taken out and a loss of 10 per cent. allowed for—say, 30 ampère hours—there will remain 70 as a deposit in the accumulator. To this add 330 ampère-hours and again 300 may be taken out, and, after deducting the percentage of loss, the same deposit remains. This will go on from day to day.

If "E," or any gentleman really interested, wishes to be practically convinced of the ability of 22 cells to light a 45-volt lamp, he may obtain ocular demonstration of it at our installation here, which we shall be happy to show to any caller.

Doubtless many of your readers are seeking further information respecting electric accumulators. If they will favour me by writing to the company's office I will always be happy, so far as is possible, to give definite replies; at the same time I would say that we cordially invite any just and disinterested criticism, looking upon it as one means to the end which all should have in view—viz., attaining the greatest possible perfection in our work.

T. Marshall Collet,
General Manager Electrical Power Storage Company (Limited),
February 1st, 1883. 4, Great Winchester Street.

[The real drift of the communication we received from "E" was not in reference to the secondary cells necessary to work a single 45-volt Swan lamp, but a number of such lamps. In the first case the external resistance is enormous compared with that of the cells, and even in the second case, with 28 lamps in circuit, the proportion of external to internal resistance affects the difference of potential at the terminals of the battery to about 4 per cent. only. The calculation of our correspondent "E" was right, but he was mistaken in the internal resistance of the Electrical Power Storage Company's cells. However, when the external approaches the internal resistance the electromotive force of the cells would be reduced, and if the external was made equal to the internal resistance the E. M. F. would be but half that indicated when the external resistance is high. Actually, the 22 cells give 47 volts, which will allow for the slight fall of electromotive force when 28 lamps are in parallel circuit.—EDS. ELEC. REV.]

The Electric Lighting Act.—Provisional Orders.

Your correspondent "Simplex," who refers to the unit of electrical measurement proposed by Mr. F. Moulton in the draft Provisional Orders for the supply of electricity, touches a practical question that has received little attention.

What appears to me to be required is an absolute measure of energy, independent of time as much as that of the consumption of a 1,000 cubic feet of gas is; the measure should be based on the decimal system for facility of reckoning, and be of such a size that the money value of the unit shall be in terms of our smaller coinage.

When preparing estimates for lighting some of the towns of Scotland under the provisions of the Electric Lighting Act, the subject of a suitable measure came under my attention, and after investigating the subject, I decided on a million watts as a good working unit which fulfilled the desired conditions; if the word meg as used with the megohm to denote a million, were prefixed the unit the megwatt would be obtained with the advantage of a distinct name.

Though the unit of 1,000 ampères flowing for one hour with the E. M. F. of one volt was adopted for these towns for the sake of general uniformity, it appears to me that it labours under many disadvantages which are absent in the more simple unit; thus the time function is introduced, the measure is in ampères, and when the quantity is converted into energy, the unit ceases to be a decimal.

The cost of 100 million watts of electrical energy compared with 16 C. P. gas in a 5 feet burner at 3s. 6d. per 1,000 cubic feet is about 7s.

E. W. Beckingsale,
General Manager and Electrician, the Brush Company of Scotland, Limited.
Glasgow, *February 6th*, 1883.

[Mr. Moulton's "unit" is more practical than our correspondent imagines. It is simply 1,000 watts. We cannot quite see the meaning of the last paragraph, unless Mr. Beckingsale intends the comparison to be for the same amount of energy obtained from gas.—EDS. ELEC. REV.]

Gardner v. Maxim-Weston Electric Company.

[In our last issue, under the above heading, we published an abstract report of certain proceedings in the Lord Mayor's Court. Mr. Watt, the Managing Director for the Defendant Company, has written to us, and we append that portion of his letter containing an explanation.—EDS. ELEC. REV.]

I am informed that under the heading Gardner *v.* the above Company, you stated in your issue of yesterday that I had called plaintiff certain epithets. He did make some such statements, but rested same on his own unsupported evidence; whereas the secretary distinctly denied the truth of his assertions, and added that his conduct on the other hand was such as to necessitate his removal by a policeman.

H. Watt.

NOTES.

Electric Lighting.—The trials of electric lighting made at the Chamber of Representatives in Belgium by the *lampe soleil* have not given the results which were expected, and we believe that the employment of this system will not be continued. A second trial was made a few days ago by the Edison Company. Lamps of 16 candles were disposed all round the semicircle, in a girdle like the gas-jets, and seven groups of four lamps were placed against the columns of the public court. After a rather difficult setting in action this lighting worked regularly for a few days. The trials are stopped, we do not know for what reason. The general effect is cold, the disposition adopted inelegant. A third trial by means of incandescent lamps and accumulators will be made towards the end of this month.

Experiments in electrical illumination have been made upon the trains between Brussels and Anvers. The light is good, but there have been extinctions, the carbons of the lamps burning under the influence of an irregular current sometimes too powerful, which has even led to total stoppages. These trials are suspended, but will be taken up again in a short time.

The Bibliothèque Royale de Bruxelles, which had adopted gas after two unsuccessful trials of electric lighting, determined to employ incandescent lamps fed by accumulators. The installation will shortly be ordered.

The Edison incandescent lamp is to be introduced into the House of Commons, so far as the corridors and passages are concerned. The Edison lamp will not, however, be used for lighting the House itself, as the gas has been found to answer all the requirements of the members and officers of the House.

In the Chancery Division of the High Court of Justice, on Thursday week, Mr. Justice Fry made an order for the winding-up of the Phœnix Electric Light and Power Company, under the supervision of the Court.

Some time since we had occasion to refer to the admirable report on electric lighting to the Vestry of Chelsea by the Vestry's Surveyor, Mr. George H. Stayton. This gentleman and Mr. Charles Mossop, the Chairman of the Electric Lighting Committee, have made some observations (adopted

by the committee) upon the Draft Provisional Order of the Metropolitan Brush Electric Light Company, which is seeking the power to supply electricity to Chelsea. We have not sufficient space at our command to deal fully with this subject, but a few extracts may be of interest. Amongst other observations the following occur:—

The chief objection to the scheme, however, is that the company are asking for powers to create a "permissive monopoly" in a manner contrary to the spirit of "The Electric Lighting Act," and altogether in our opinion not for the public benefit.

Although the company have scheduled the entire parish as the "proposed area of supply," they only seek to expend capital to the amount of £14,040. Such a sum would be ridiculously inadequate for so extensive an area.

The provisions with regard to:—(*a*) conditions of supply; (*b*) affording relief from compulsion to lay mains in such streets as the company may think fit; (*c*) omitting such streets from the area of supply (but not otherwise relinquishing the company's right over the same); (*d*) the various delays which would occur before the company could be declared to have made default; (*e*) the relief of the company from penalties for neglect and failure to supply; (*f*) the mode of procedure in respect to laying electric mains; (*g*) the breaking up of streets; (*h*) the sub-division of the area of supply; (*i*) the power to make the supply intermittent; (*j*) the cost of service lines under the streets; (*k*) the price and mode of measurement; (*l*) the penalties for default; (*m*) partial revocation of the Order; (*n*) the transfer of the undertaking, and (*o*) the duration of the Order, *are such as in our opinion would render it desirable in the interests of the ratepayers to entirely reject the scheme rather than to submit to the onerous conditions which the company seek to impose.*

Under the proposed system of relief from compulsory supply the inhabitants of the more unimportant streets may for ever be prevented from obtaining the benefits of electricity, it being obvious that if the company were to supply the principal streets only, it would not answer the purpose of another company to take the smaller streets alone, by reason of their isolation, irregularity of consumption, and the cost of supply.

With a view to facilitate the introduction of electricity into Chelsea upon a satisfactory basis, at as early a date as possible, and in preference to offering the existing scheme an uncompromising opposition, an amended scheme has been propounded by the surveyor, and his plan forms the foundation of the necessary amendments which the Board of Trade should be asked to include in the draft Order.

The amended scheme proposes that the company should forthwith select one of the three areas (or a modification thereof) suggested by the surveyor; and that the obligation to supply the area so prescribed be compulsory, but progressive in the manner specified in the schedules.

At a meeting, on Monday evening last, of the special committee appointed to consider the question of electric lighting for Dundee, the gas manager reported additional information on the subject, including communications from Edinburgh that the experiments there had been given over, having proved unsatisfactory, and from Norwich to the effect that the lighting had not turned out well, and that the cost as compared with gas was as 270 to 1,000. The committee resolved to ask information from other towns.

The *Dundee Advertiser* understands that the Gas Commissioners have been in communication with the Brush Electric Light and Power Company (Scotland) in regard to the subject of the electric light. Both the commissioners and the company have given notice of Provisional Orders for supplying the electric light to the town, and it is expected that the result of the communications which have passed will be to allow the company to get their Order sanctioned and provide for the withdrawal of the Order promoted by the Commissioners. In this event the Commissioners would, under the general Act, be able, if they see fit within a given time, to take the place of the company.

In a recent issue we notified the installation of the electric light at Messrs. P. & P. Campbell's Perth Dye Works. As is well known, one of the drawbacks of the dyeing industry is that during the winter months, when daylight does not exceed six hours, comparatively little work can be done, as many of the processes cannot be carried on by gaslight. Messrs. Campbell are so well satisfied with the electric light, which has removed the above-named difficulty and enabled every department of their extensive works to be carried on as efficiently at night as during the day, that they have instructed the Northern Electric Light and Appliance Company, Limited, Dundee, to increase the number of lights. At present more than half of the establishment is fitted up with the electric light, and it has given so much satisfaction that the firm is contemplating the advisability of dispensing with gas. The dyehouse, which covers about three-quarters of an acre, is to be wholly lighted by electricity. Already nine lamps have been fitted up, arrangements have been made for putting in four others, when the lighting there will be completed. The sewing-room is now thoroughly lighted by the electric light, and at the same time the air is kept perfectly fresh and cool. Among the other parts of the establishment in which electricity has been substituted for gas is the French cleaning department. No open lights are permitted to be used in it, and eight incandescent lamps have been fitted up. Altogether, the Messrs. Campbell are thoroughly pleased with the changes which have been made in their lighting arrangements.

The Edinburgh Town Council has forwarded to the Board of Trade a letter of objections to the proposed Provisional Order for authorising the Brush Electric Light and Power Company of Scotland (Limited) to supply electricity for public and private purposes within part of the city. In the letter it is stated that in 1881 the Corporation entered into an arrangement with the Brush Light Company for the lighting of Princes Street, North Bridge, and Waverley Bridge, but the experiment turned out a complete failure in so far as lighting was concerned, while the cost was such as no community could undertake to incur. The fact of the experiment which was thus made might serve, on the one hand, to dispose of any suggestion that the Corporation would be backward in the application of improved practical lighting, and, on the other hand, the result would prove the inexpediency of this company being permitted to experiment in lighting the streets of Edinburgh.

In Mr. Justice Chitty's Court, on the 2nd inst., the fourteen notices relating to the "Brush" Midland Electric Light Company were ordered to stand over for another week, upon the statement of Mr. Walter, Q.C., that orders by counsel were being arranged in all of them.

Transmission of Power to a Great Distance.—On the 6th inst. experiments were made at the workshops of the Chemin de fer du Nord on the transmission of power to a great distance through an ordinary telegraphic wire by M. Marcel Deprez, and our Paris correspondent was invited to witness these experiments by the Syndicat Français d'Electricité. We hope to give shortly a detailed description of the experiments and the particular arrangement of the machines, but it appears that it is impossible to draw any conclusion from these experiments, at least under the conditions in which the circuits were established.

The two dynamos, generator and receiver, were placed side by side and connected by two conductors, one only a few mètres long, the second formed by a telegraph wire (iron) 20 kilomètres long and 4 millimètres in diameter, established between the workshops of the Chemin de Fer du Nord and Le Bourget.

In glancing at the sketches* it will be seen that the

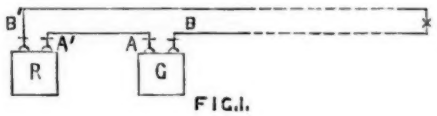


FIG.1.

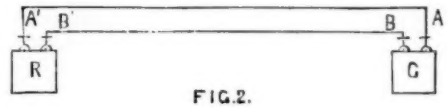


FIG.2.

telegraphic wire takes the place of a more or less perfect earth contact, more perfect as the insulation of the line is more imperfect. The true line is constituted by the copper wire a few mètres long, perfectly insulated, which connects the two machines between A and A^1 (fig. 1). The intensity of the current which traverses the two machines is always the same. The leakages on the wire, B B^1, have the effect of *increasing* the work produced by the receiver, the reverse of what would occur if the machines were placed at a distance as they are in practice (shown in fig. 2). In this case these leakages have the effect of *decreasing* the work produced by the receiver. The conditions of the experi-

* In fig. 1 G is the generator and R the receiver, side by side. A A^1 is the short line directly connecting the two machines, and B B^1, the telegraphic line to Le Bourget and back. In this case leakage on the line *increases* the work produced. Fig. 2 represents the ordinary method of connecting up for electrical transmission of power, and in this case leakage in the line *decreases* the work produced by the receiver.

ment at the Chemin de fer du Nord therefore prevent us from drawing any conclusion relative to the actual influence of losses by the actual line.

A Throat Electric Lamp.—At the last meeting of the Leeds and West Riding Medico-Chirurgical Society, Mr. Margetson, of Dewsbury, exhibited an incandescent lamp, designed by himself, and used by him since October last in examining the mouth and throat. The globe was about half the size of a walnut. It can be held in the mouth for two minutes without discomfort from the heat.

International Electrical Exhibition, Vienna.—We stated in a recent issue of the ELECTRICAL REVIEW that an International Electrical Exhibition will be held in Vienna under the patronage of the Austro-Hungarian Government, in the months of August, September, and October next. At the request of the Austrian Minister of Commerce and of the managing committee of the exhibition, the Council of the Society of Telegraph Engineers and of Electricians have appointed a committee for the purpose of receiving applications for space from intending British exhibitors, and for promoting generally the formation of a British section. Application should be made as early as possible, and should be addressed to the Secretary of the Society of Telegraph Engineers and of Electricians, 4, The Sanctuary, Westminster, S.W.

Colliery Pumping by Electricity.—The Electric Carbon Storage and Apparatus Manufacturing Company of Scotland, Limited, have just concluded arrangements to do the pumping at the margin of Lothian's Collieries at Dalkeith, by electricity, with one of Dr. Higgs' dynamos on the surface, and his improved motor below ground.

The Electrical Exhibition, Royal Aquarium.—This exhibition, which is rapidly approaching completion, seems likely to surpass, in electric lighting appliances at all events, anything which has gone before. The chief novelty in machines will probably be the exhibit of Messrs. Ferranti, Thompson and Ince. We have on more than one occasion spoken of the Royal Aquarium as being, perhaps, the most accessible place, from all parts of London, for the purpose it is now being devoted to. As far as we are able to judge, success must be assured.

The Electric Lighting Act.—We have recently perused the Draft Provisional Order of a certain electric light company served upon the Holborn and St. Giles' districts. The drafting of this Order seems to have been attempted by some one so utterly incompetent for the task, that it is a source of wonder to us whether the local authorities, on whom these Orders have been served, could have done otherwise than decline to waste any time in considering it. Consumers will no doubt be found in immense numbers to ask for a supply of electricity at such a price as may be fixed from time to time by the *undertakers;* also, to right gladly enter into a written contract with the undertakers to receive and pay for the supply for a period of five years, and to give *security* for this payment. The comparison between that to which we refer and Mr. Fletcher Moulton's really admirable "Provisional Order" is made to some extent apparent when we say that the former contains but 17 badly drawn-up clauses, whilst in the latter almost every point that can be imagined is exhaustively dealt with under five times the number of headings.

Dangers from Electric Lighting.—We should feel greatly favoured if any of our correspondents, at home or abroad, could supply us with any facts which may have come within their knowledge relative to the deaths of any persons occasioned by the use of dynamo-electric machines. Particulars required, such as date, place of accident, system employed, current whether alternating or direct, type of machine used, &c., &c.—[EDS. ELEC. REV.]

The Elphinstone and Vincent Continuous Current Machine.—We have received an intimation from Mr. Vincent that engineering difficulties connected with the driving arrangements prevented the two machines, of which the experimental trials are recorded below, from being worked at their normal speed of 1,000. The tests taken at lower speeds may, however, be of some interest. The water resistance was used (as described in a late number of the ELECTRICAL REVIEW), the current being expended in electrolysis. This requires careful regulation, as, until the boiling point of the liquid is reached, its resistance is falling the whole time the current is running through it. The readings of Ayrton and Perry's volt and ammeters were, therefore, taken simultaneously by two observers, and the resistance at the particular moment worked out by Ohm's law. The armature resistance of each machine is ·0328 ohms. The field magnet resistance is 4·48 ohms. The resistance of the external circuit should have been

$$4{\cdot}48 \sqrt{\frac{{\cdot}0328}{{\cdot}0328 + 4{\cdot}48}} = {\cdot}381\ \omega$$

Unluckily, in the hurry of experimenting with the E No. 9 S machine, this point was passed, and with the E No. 10 S, failure of steam brought this trial too early to a close.

When these machines have been worked for a few days the results obtained will be somewhat better. The temperature of the armatures at the close of the experiments was 80° to 90° Fahr. They felt barely warm to the hand.

E No. 9 S.

Current. Ampères.	E. M. F. Volts between terminals.	Volt Ampères.	Resistance in External Circuit.	Revolutions of Armature per minute.
236·5	78·3	18,517	·33	900
239	81·2	19,426	·33	900
236	83·5	19,706	·35	905
215·6	88·4	19,068	·41	900

E No. 10 S.

247·5	79·75	19,738	·32	910
247·5	84·1	20,812	·33	900
247·5	87·	21,532	·35	910
247·5	89·1	22,051	·36	930

Science Lectures in Edinburgh.—Two lectures on "Electricity: its Characteristics and its Uses," with illustrations and experiments, will be delivered by J. H. A. Macdonald, Associate of the Society of Telegraph Engineers and of Electricians, in the Philosophical Institution, on the evenings of February 20th and 23rd.

The Telephone.—That the telephone is finding much favour in Italy is evidenced by the fact that there are already in Rome 651 telephones, in Turin 454, in Naples 413, and in Milan 390.

The contract for telephonic communication between the Town Council of Dundee and the Post-office terminates in March next. The necessity for arranging with some other contractor was before the council last week. The Lord Provost, in moving the appointment of a committee, remarked "that there was no doubt they could have a cheaper and better service than they frequently had from the Post-office authorities."

Advices from Sydney say that on the night of the 12th December last an accident happened, by which the offices of the Telephone Exchange Company, at Sydney Exchange, were wrecked. The wires leading to the switch-board were partially fused, and the switch-board itself charred, the centre of the roof of the office blackened, and the floor bespattered with melted gutta-percha. Outside, the telephone wire which leads to Messrs. Montefiore, Josephs & Company's establishment was found hanging down, fused, while the electric-light wires were all secure. Messrs. Montefiore, Josephs & Company's wire hangs above and across the electric-light wires, and it is presumed that it elongated and made contact with them.

The Telephone and the Post-office.—Mr. Stewart Pixley, chairman of the London and Globe Telephone and

Maintenance Company, Limited, in a letter to the editor of the *Times*, dated February 6th, says:—"As chairman of a telephone company now putting up exchanges in London for the purpose of supplying cheap telephonic communication to the public, I think it only right to say, in answer to 'Shareholder's' letter in the *Times* of to-day, that, so far from meeting with a 'how not to do it' policy on the part of the Post-office officials, we have received a liberal and generous treatment at their hands. I would ask 'Shareholder,' has it not been the costly attempt of the United Telephone Company, Limited, to create and maintain a monopoly for themselves at the expense of the public, rather than the restrictions of the Post-office, which has prevented, up to the present, the proper and natural development of this invaluable means of communication?

The United Telephone Company v. Dale.—Before Mr. Justice Fry, in the Chancery Division of the High Court of Justice, on Thursday week, an injunction was taken by consent in this action to restrain the sale of parts of telephones in infringement of Bell's and Edison's patents, held by the plaintiff. Mr. Cozens Hardy, Q.C., and Mr. Moulton appeared for the plaintiffs. Mr. Farwell, for the defendants, said they had no idea that they had been acting in contravention of the plaintiffs' rights, and apologised on their behalf.

Proposed Telephonic Communication Between Lundy Island and the Mainland.—Mr. Chamberlain was asked at Swansea on Friday week whether Government would assist in the establishment of a telephone wire between Lundy Island and the mainland. It is understood that Lloyd's have now determined to erect one within six months, provided they can obtain a subsidy of £600 a year from merchants and others on the Channel.

The Telephone in Canada.—We notice in one of the Montreal papers that the Bell Telephone Company has at the present telephone offices in about 100 towns and places in Canada, and employs a staff of more than 250 men, the number of subscribers amounting to 4,250. The company possesses at Montreal a large factory, where all the instruments and apparatus used in Canada are manufactured. The number of subscribers in the principal towns is as follows:—Montreal, 866; Toronto, 525; Hamilton, 320; Ottawa, 250; St. John, N.B., 275; Winnipeg, 250; Quebec, 240; London, 230; Halifax, 170; Victoria, B.C., 130. During the last year the company laid nearly 1,000 miles of telephone lines.

The Telegraph Steamer "Professor Morse."—We are informed that the s.s. *Professor Morse*, belonging to Western Union Telegraph Company, New York, and for the last ten years the repairing ship of the International Ocean Telegraph Company, has been sold and will now be used as a cargo boat in the coal trade. The *Professor Morse* made her *début* as a telegraph steamer under the name of the *Suffolk*, when she was bought by the West India and Panama Telegraph Company, during the laying of the West India cables in 1870-71, by Sir Charles Bright. On becoming the property of the Western Union Telegraph Company she was re-christened the *Professor Morse*, and has been employed in the laying and repairing of the Havana-Key West and Key West-Punta Rassa (Florida) cables.

She was built in 1866, on the Clyde, by the Marine Investment Company, is made of steel and has a tonnage of 1,023 tons gross and 695 tons register. Her dimensions are 257·5 ft. long by 28 ft. beam by 19·4 ft. deep.

The Channel Islands Cable.—The s.s. *Dacia*, Captain P. M. Hayward, chartered by the Post-office for the repairs of the Channel cable, left her moorings on Monday, the 5th inst., for Greenhithe, and after having adjusted her compasses, sailed from there on the following day.

How to get Telegraph Wires under Ground.—We read the following in the *Philadelphia Ledger*:—The proposition to tax overhead electrical conductors at twice the rate per mile charged for underground conductors a discrimination in the right course, but only good so far as it goes. It might be improved so as to make the tax an incentive to a prompt removal of overhead wires from the streets. If the tax on underground wires should be made merely nominal for five or ten years, it would put no obstacle in the way of a costly enterprise that is necessarily attended with considerable risk to the investors. But, on the other hand, the tax on overhead wires should be made heavier year by year, until it becomes prohibitory. That is probably the simplest and most effective way of compelling the removal of overhead wires from the streets. If five dollars per mile is a sufficient tax now, it should be raised to ten in 1884, to twenty in 1885, and so on until there are no more overhead wires to tax. But fair warning should be given, so that the telegraph, telephone, and electric light companies may have an opportunity to avoid such taxation by putting their conductors under ground.

Telegraphic Extension in Shetland.—Mr. Laing, M.P., writes to his constituents in Lerwick that the Treasury has decided to follow the advice just given by the Scotch Fishery Board to appropriate a portion of the Surplus Herrings Brand Fund to the extension of the telegraph to the outlying fishing stations in Shetland. Lord Rosebery, Sir Donald Currie, Mr. Dundas, and Mr. Pender, M.P., co-operate in the movement, and Mr. Pender thinks that representation should be made to the Government to make telegraphs to the outlying districts merely a question of revenue.

The Proposed New Cable across the Atlantic.—The alleged abandonment of the project of a new and independent telegraph cable across the Atlantic Ocean, in connection with the Baltimore and Ohio inland system, is now contradicted. The report of the abandonment (says the *Operator and Electrical World* of New York) probably owed its origin to the announcement that the Direct and the French Cable Companies were about to open an office at 40, Broadway, in New York, where messages will be received from the public and from land line companies other than the Western Union Telegraph Company, as well as from that company. This arrangement, it was proclaimed, by giving proportionate facilities to all the inland companies, would render the laying of an opposition cable unnecessary. The Direct Cable office at 40, Broadway, was opened on the 23rd ult.

The London and Globe Telephone and Maintenance Company v. the United Telephone Company.—In the Chancery Division of the High Court of Justice on Thursday week the motion of the plaintiff company to commit certain directors and officers of the defendant company for issuing an advertisement in an alleged breach of an injunction came on for hearing. On June 22 last his lordship granted an interim injunction restraining the defendant company, their servants, and agents from stating that the telephone instruments known as Hunnings' transmitters cannot be manufactured, sold, supplied, or used in this country except under the licence of the defendants, or any statement to that effect, without reference to the decision in the action of the United Telephone Company *v.* Harrison, Cox-Walker & Co. The following are the terms of the advertisement referred to, which appeared in the *Bradford Observer* of the 13th ult.: "On the 15th December, 1882, in an action brought by the United Telephone Company (Limited) against F. Hebden & Co., carrying on business as telegraphic engineers at Bradford, in Yorkshire, to restrain them from manufacturing, selling, supplying, or using telephones which were infringements of the Bell patent, a perpetual injunction was granted against the defendants, with damages and costs, restraining them from further infringement and directing the delivery up, upon oath, of all infringing instruments in their possession or under their custody or control. The public are hereby warned against using infringing instruments supplied to them by Messrs. F. Hebden & Co. or by any other person. Proceedings will be taken against any person manufacturing, selling, supplying, or using except under licence from the United Telephone Company, any form of magnet telephone (whether known as the Hickley, Ader, Cox-Walker, or by any other name or any form of transmitter in which carbon or any other equivalent substance is employed, whether in the form of hard pencils (usually known as the microphone transmitter), or in the form of a loose powder, as in the Moseley and Hunnings transmitter."

Mr. Hemming, Q.C., and Mr. Northmore Lawrence, for the motion, argued that the advertisement was a disingenuous evasion, and in effect, did what the company were enjoined from doing—held out to the world that Hunnings' instruments could only be sold under a licence from the defendant company.

Mr. Cozens Hardy, Q.C., and Mr. Moulton, for the United Telephone Company, opposed.

His Lordship considered that the threat contained in the advertisement was not a breach of the injunction, which was confined to

statements of facts. At the same time he considered the advertisement drawn with great ingenuity in a way calculated to mislead persons who were not conversant with what had happened, and, in refusing the motion, he ordered the question of costs to stand over till the hearing.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Electric Carbon, Storage, and Apparatus Manufacturing Company of Scotland (Limited).—The return of this company, made up to the 30th August, 1882, was filed on the 5th inst. The nominal capital is £150,000, in £1 shares; 27,517 shares have been taken up, and a call of 10s. per share has been made thereupon. The calls paid amount to £13,027, leaving £731 10s. unpaid. Registered office, 1, Sherborne Lane, King William Street, E.C.

NEW COMPANY REGISTERED.

China and Japan Telephone Co. (Limited).—Capital, £20,000, in £1 shares. Objects:—To take over any existing telephone exchanges and businesses carried on in China and Japan, including Shanghai and Hong Kong, and to use, manufacture, and dispose of the telephonic apparatus of the Oriental Telephone Company (Limited), of 3, Great Winchester Street, E.C., of James Draper Bishop and Archibald John Little, of Shanghai, trading as the Mutual Telephone Association; and of the Western Electric Company of New York. Signatories (with one share each):—Colonel G. E. Gourand, Upper Norwood; W. G. Hall, 13, Telford Avenue, Streatham Hill; J. S. Cooke, C.E., 5, Raymond Buildings, Gray's Inn; H. A. Yeutsch, 17, Tugela Road, Clapham Junction; J. Bykes, 26, Tavistock Street, W.C.; R. S. Cuff, Electrician, 5, Cedar Road, Tottenham; G. Newington, East Dulwich. Registered 31st ult., by Messrs. Renshaw & Co., 2, Suffolk Lane, E.C.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

2558. "Generation, storage, &c., of electricity." J. S. WILLIAMS. Dated May 30. 1s. Relates to apparatus for the generation, storage, &c., of electricity, together with methods of constructing the various parts employed. The specification is too voluminous to enable any details to be given.

2569. "Electric lamps." T. E. GATEHOUSE and H. R. KEMPE. Dated May 31. 6d. Relates to apparatus for automatically regulating the distance of the carbons or electrodes of electric lamps so as to maintain approximate uniformity in the voltaic arc and to provide for the feed of the electrodes as they are consumed. For this purpose the inventors arrange in the framing of the lamp a solenoid or electro-magnet, the core or armature of which is drawn away by an adjustable spring. By means of a make and break arrangement of any known kind, intermittent electrical currents, either from the lamp circuit or from another source, are caused to pass through the coils of this solenoid or electro-magnet, so that its core or armature is alternately moved one way by the magnetic attraction and the other way by the spring, thus giving continuous reciprocating movement to an arm jointed to the core or armature. To this reciprocating arm there is jointed the core of another solenoid, the axis of which is perpendicular or nearly so to the reciprocating arm, and the core of this, which we may term the deflecting solenoid, is drawn away by an adjustable spring. The end of the reciprocating arm has a tooth on each side, and it moves to and fro between two ratchet wheels without touching either of them unless when it is deflected to the one side or the other by the attraction of the deflecting solenoid exceeding the force of the spring, or conversely. On the axes of the two ratchet wheels are fixed rollers which bear against one side of the lamp carbon, another roller being pressed against the other side of the carbon by a spring, so that the carbon is clamped between the rollers and is caused to move in the one direction or the other according as one or the other of the two rollers on its one side is caused to turn in the one or the other direction. The deflecting solenoid whose core acts laterally on the reciprocating arm may be arranged in either of two ways. According to the one arrangement, its coil forms part of the lamp circuit, and the action is then as follows. When the carbons are too near each other, the solenoid attracts its core, deflecting the reciprocating arm so that its tooth engages with one of the ratchet wheels, which it turns step by step in such direction as to withdraw the carbons from one another; when, on the other hand, the carbons are too far apart, the spring overcoming the attractive power of the solenoid deflects the reciprocating arm in the opposite direction, so that its tooth engages with the other ratchet wheel which it turns step by step in such direction as to advance the carbons towards each other. When the solenoid is thus arranged in the lamp circuit, the inventors apply to the lamp a shunt of any known kind so as automatically to complete a by-pass and maintain the general circuit in case of the extinction of the lamp. It is preferred, however, to arrange the deflecting solenoid, not in the lamp circuit, but in a by-pass circuit, making this by-pass one of considerable resistance by including in it a carbon filament fixed in a vacuous bulb, as in an incandescent electric lamp, not for the purpose of illumination, but for the following object. The electrical resistance of a carbon filament is lessened when the filament is heated. Thus when, owing to too great separation of the electrodes of the lamp, the resistance of the arc becomes too great, a considerable portion of the lamp current has to find its way through the by-pass which includes the solenoid coil and the carbon filament. The filament becoming heated offers less resistance, and consequently permits the passage of a greater portion of the current, and thus the deflecting solenoid is rapidly and forcibly excited, attracting its core and so causing approach of the lamp electrodes, and lessening the resistance of the lamp circuit. This use of a carbon filament for the purpose of rapidly varying the resistance of a circuit is obviously applicable generally to electric lamps in which there is a by-pass circuit including a solenoid coil or electro-magnet for regulation of the arc.

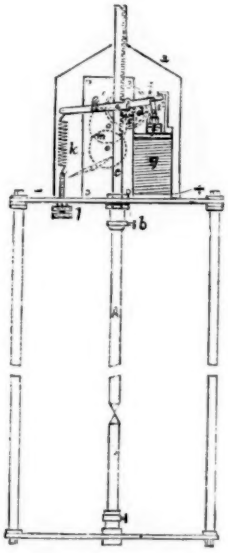
2630. "Dynamo-electric machines." A. J. JARMAN. Dated June 5. 6d. The improvements consist in so forming the pole caps, or inducing pieces, of the field magnets of dynamo machines, or the pole caps of the inducing magnets of magneto-electric machines, as to be adjustable with regard to each other, and to the armature revolving within such pole caps or inducing pieces.

2641. "Telephonic communicators for use as fire alarms, &c." A. W. ROSE. Dated June 5. 6d. Has for its object to provide means more especially adapted for a system of fire alarms for towns or cities, but which are also adapted for other analogous purposes, such as for communicators at docks or in large open yards or works.

2642. "Registering the amount of work given electrically to any part of an electric circuit in a given time." W. E. AYRTON and J. PERRY. Dated June 5. 4d. To measure electrical energy given to a house or to any motor or lamp or other contrivance during a given time it is at present necessary to use such an instrument as the inventor's voltmeter to measure the difference of potential existing at any instant between the two extremities of the portion of a circuit in which the expenditure of energy occurs; at the same instant to measure with such an instrument as the inventor's ammeter the current flowing. The product of these measurements multiplied by a certain constant number gives the horse-power which is at that instant being given electrically to the circuit; or the horse-power being expended at any moment may be measured by an instrument like our electric power-meter. If these operations are repeated at equal intervals of time it is possible to calculate approximately the electric energy given to the circuit during any time. The present invention is an instrument which continually performs this operation, and shows by pointers on dials the total amount of energy which has passed electrically into a circuit since any previous date. It consists of a small machine shaped like a dynamo-electric machine. The movable armature of this machine is wound with moderately thick wire. The fixed magnets are wound with a wire whose resistance may be more than 200 ohms, or again, the moving part may have a considerable resistance, and the fixed may have the smaller resistance. The cores in both cases may be of very soft iron, or other magnetic matter, or they may be of non-magnetic matter, so that they cannot become permanently magnetic, or of electrically non-conducting matter. The ends of the bobbin, of high resistance, are connected with the extremities of the portion of an electric circuit whose supply of energy we wish to measure, the main current, or any fractional portion of the main current, being allowed to pass through the coils of smaller resistance. It is well known that the torque, or average force, acting between the movable and fixed parts is proportional to the product of the currents flowing in them, and this is evidently proportional to the horse-power which is being expended in the main circuit; hence the horse-power so expended, multiplied by the velocity with which the movable part is made to rotate, is proportional to the mechanical power given out by the motor. If now the only work done by the motor is done in overcoming fluid friction, or in causing magnets to revolve in front of metallic plates, such as copper, as in Arago's disc experiments, the forces resisting motion are proportional to the velocity, and it is obvious that the number of revolutions made by the motor in any time is proportional to the electrical energy given to the circuit in that time. The only work, therefore, done by the motor is the moving of vanes in the liquid or in the relative motion of magnets and conductors, with the exception of the small amount of work necessarily done in overcoming the friction at the bearings of the machine. The number of revolutions made by the motor in any time is determined in much the same way as that employed in gas or water meters, and the electric energy given to a house or a machine, or a lamp, or any other contrivance or number of contrivances during any period of time is represented by the difference of the readings of the instrument at the beginning and end of the time in question, just as in a gas or water meter the quantity of gas or the quantity of water is measured.

2654. "Electric lamps." R. J. HATTON and A. L. PAUL. Dated June 6. 6d. The object of this invention is to produce an electric lamp which will give a clear steady illuminating electric arc by a novel arrangement of apparatus which will regulate and maintain the points of the carbon between which the arc is formed at one even and uniform distance apart. The fig. represents the improved construction of electric arc lamp in which the lower carbon is fixed and the upper one movable. *a* is the frame and casing of that portion of the lamp containing the apparatus giving motion to the upper carbon: A and B is the lower, or fixed carbon. The upper carbon, A, is secured by the set screw, *b*, to the rack, *c*, which is supported in a position which will allow it to be acted upon in the manner, as hereinafter described, for the purpose of automatically feeding and maintaining a uniform

distance between the points of the carbon forming the arc of light whilst the current of electricity is flowing and gradually consuming the carbons. Into the tooth of the rack, *c*, gears the pinion, c^1, on the axle, or arbor, of which is secured the ratchet wheel, *d*. The lever, *e*, which has its fulcrum at e^1, is connected at the end of its longer arm by the link, e^2, with the plunger, *f*, which is surrounded and actuated by the solenoid, *g*. Also to the end of the longer arm of this lever, *e*, is secured the spring pawl, *i*, and to the other, or shorter arm of the said lever, is secured the spiral spring, *k*. A train of wheels and fly, *m*, are employed to regulate the speed of the descending carbon by means of a catch and ratchet wheel, they are only actuated as the carbons descend. The action of the various parts herein referred to,



giving motion to the upper carbon, A, whilst slowly consuming during the time the current of electricity is flowing between the points of the carbons forming the arc, will be understood on reference to the drawings and following description thereof. When the current is applied the plunger, *f*, is drawn down into the solenoid, the action of which brings with it the lever, *e*, which causes the spring pawl, *i*, to engage with and give motion to the ratchet wheel, *d*, the action of which transmits through the pinion, c^1, and rack, *c*, a lift to the upper carbon, A, and forms the arc. As the current weakens through the lengthening of the arc, by reason of the consumption of the carbon, the attraction of the solenoid becomes less, and the plunger, *f*, is withdrawn by the spiral spring, *k*, acting on the lever, *e*. The rise thus given to the plunger and long arm of the lever, *e*, lifts the spring pawl, *i*, from the ratchet wheel, *d*, and thus allows the carbon, A, to descend until the arc is readjusted and the spring pawl, *i*, again engages with and comes into gear with the ratchet wheel, *d*. The spring pawl, *i*, when the lamp is burning is just on the point of releasing the ratchet wheel, *d*, so that the slighest weakening of the current is at once corrected by a release of the ratchet wheel, and consequent feed of the carbon as already described. The length of arc may be regulated by means of the adjusting screw, *l*.

2658. "Secondary batteries." A. MUIRHEAD. Dated June 6. 4d. This invention relates to improvements in the preparation or formation of the metallic electrodes employed in the construction of secondary batteries of the Planté type, whereby economy in time and cost of production are obtained. In carrying out this invention the formation of the active surfaces of the lead plates is effected by decomposing electrically a solution of a salt of lead, such as the acetate, which is kept flowing in a continuous stream during the electrolysis between the two sets of plates, to form the electrodes of the battery, and these plates are coupled with a dynamo-electric machine or other suitable electric source.

2659. "Primary and secondary batteries." W. B. BRAIN. Dated June 6. 2d. In the provisional specification of the patent application, dated March 30, 1882, there are described electrodes for secondary batteries consisting of chambers, or envelopes of thin perforated sheet lead, containing the red lead or other oxidising or deoxodising or other acting agent. Now according to this invention the inventor increases the efficiency of such electrodes by subjecting them to a considerable pressure before or after the preliminary charging operation, so as to produce a plate or body possessing great solidity and density. (*Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.*)

2660. "Carbon burners for electric lamps." J. WETTER. (A communication to him from abroad by W. Stanley, of America.) Dated June 7. 4d. It has been found that hair from the human head, as well as that taken from the bodies, mane and tails of certain animals, is admirably adapted for the manufacture of carbon burners for incandescent electric lamps. The present invention consists in a carbon burner for electric lamps produced from hair; also in the method of preparing or producing such hair carbons.

2661. "Producing and measuring electric currents." J. BLYTH and D. B. PEEBLES. Dated June 7. 6d. Has for its objects the producing and measuring of electric currents by improved apparatus. For the production of electric currents by this invention a dynamo-electric machine is employed having a rotating armature consisting of a cylindrical ring of soft iron by preference in the form of wire and having wound upon it a number of separate coils of insulated wire. Between the coils there are iron links by means of which the armature ring is fixed to one end or edge of a cylinder, by preference of iron which has at its other end a disc or spokes connecting it to a boss fast on the shaft to which the driving power is applied. The coils of a wire are connected to a commutator on the shaft to and from which the current is led by usual appliances. Separate electro-magnetic pole-pieces are arranged to act upon the outer and inner sides of the armature ring, and the magnet shanks or bodies of the external pole-pieces are excited by coils of insulated wire which are separate and distinct from similar coils employed to excite the magnet shanks or bodies of the internal pole-pieces. With these arrangements what may be termed a double machine is formed, as it may be used to produce currents with either the internal or external electro-magnets removed, and its action is greatly increased when both are employed. For measuring an electric current produced by the dynamo-electric machine or otherwise a shunt circuit of comparatively great and known resistance is derived from the main circuit by means of two wires which are led to separate electrodes immersed in water in a closed vessel. The shunt current causes electrolysis of the water and the oxygen or hydrogen or the two combined are led from the closed vessel by a pipe to a rotating drum arranged like that of an ordinary wet gas meter. Counting wheels with indicators and dials are connected with the drum to show the quantity of the gas going through the drum, and as the production of this gas has a known and definite relation to the current passing through the main circuit, the indications thus obtained serve as a convenient measure of that current. When the electrolytic apparatus is arranged to deliver the oxygen and hydrogen of the water separately the measuring drum of the meter is divided by an internal partition or partitions which keep the gases separate when passing through it, and provision may also be made for directing the gases to separate outlets after leaving the drum. For keeping a sufficiently constant level of the water in the meter any suitable apparatus or contrivance may be adopted such as is used in ordinary wet gas meters: or a hydrocarbon or other oil of a non-volatile character may be used instead of water.

2674. "Electric lamp." E. DE PASS. (Communicated from abroad by J. Gloker, of Paris.) Dated June 7. 4d. This invention has for its object a new arrangement of electric lamp, in which the luminous arc is automatically regulated by the current passing in a single circuit. For this purpose the inventor employs two solenoids whose casings are of suitable form, and bear great resemblance to the frame carrying the wire of a multiplying galvanometer. The outside of the casing is covered with several coils of wire. In this casing moves an iron bar or plate, mounted on an arbor which carries a piece of soft iron, and which serves as an armature for the upper carbon-holder passing into the casings of two resistance coils, and said armature is magnetised when the current passes in the single circuit; the carbon-holder is movable in a vortical direction. When a current is caused to pass through such an arrangement of solenoids, the iron bar or plate moving in the casing tends always to occupy a position perpendicular to the direction of the parallel coils of the solenoids, so that, in the case under consideration, the armature which is fixed on the same arbor as the iron bar or plate, and almost normally to the same, approaches the stem of the carbon holder, and being in the magnetic field of this stem all the oscillatory movements of the armature will be transmitted to the stem which will receive corresponding rectilineal movements, and will thus cause approach or separation of the upper carbon from the lower, which latter is a fixture. (*Provisional only.*)

2675. "Telephones." H. ALABASTER, T. E. GATEHOUSE, and H. R. KEMPE. Dated June 7. 6d. Relates to a novel construction and arrangement of a telephonic receiving instrument and to the combination therewith of any known transmitting instrument. At each end of a suitable case is fixed a plate and stretched between these plates an iron or steel wire, round which are closely wound two coils of insulated wire. One of these coils, which may be of coarse wire, connects the poles of a local battery, the other coil, which is preferably of fine wire is connected to the line at its one end, and to earth at its other end. When electrical undulations produced by pulses of sound on a transmitting instrument of any known kind are sent along the line, the iron or steel wire of the receiving instrument above described is acted on and its plates are caused to vibrate, reproducing the sounds which actuate the transmitter. It is convenient to enclose the two plates of the instrument in casings and lead from these casings flexible tubes so that the sounds can be conveyed to both ears. A transmitting instrument of any known kind can be connected into the wire of the local battery, and this transmitter will serve for sending to the distant station.

2676. "Preparing electrodes for secondary batteries." A. M. CLARK. (Communicated from abroad by J. M. A. Gérard-Lescuyer, of Paris.) Dated June 7. 4d. Most salts of which the radicle is an oxide acting as an acid, are powerful oxidising agents, and this invention consists in the application of this remarkable property to the rapid formation of secondary pairs. In an electro-chemical bath containing one or more of these salts, the inventor substitutes for the soluble anode the secondary pair to be formed. The two poles of this pair are connected together and attached to the positive pole of the generator of electricity which is to decompose the bath, and at the negative pole is placed a plate of any suitable metal or of carbon. Under the action of the current the negative pole becomes metallised, whilst the lead forming the anode becomes rapidly oxidised at the expense both of the bath and of the decomposed salt whose oxygen goes to the positive pole. The application of heat augments or hastens these results.

2686. "Electric lamps." M. A. WIER. Dated June 8. 2d. The object of the invention is to produce a lamp which shall give a more steady and constant light than is attainable in the electric arc

lamps at present in use, and at the same time to increase the size and power of the light. The invention consists in causing one or both of the electrodes to revolve on its own axis at a considerable velocity. The centrifrugal force generated by this rotation causes the incandescent particles to be thrown outwards, whereby the light is spread out into a larger circular space, and a better and steadier light is obtained. Any clinker which would otherwise form on the electrodes, and impair the lighting effect of the arc, is also by this means carried away or thrown out. (*Provisional only.*)

2688. "Voltaic batteries." C. G. GUMPEL. Dated June 8. 2d. Relates to a construction of voltaic batteries, either primary or secondary, so as to render them conveniently portable in order that they may be readily moved from place to place, to be applied for lighting in mines, apartments, carriages and elsewhere, or for other purposes for which electricity is employed. (*Provisional only.*)

2694. "Dynamo or magneto-electric machines." W. R. LAKE. (A communication from abroad by E. Weston, of America.) Dated June 8. 6d. This invention embraces improvements in winding, and connecting to the commutator, the armature-coils of dynamo-electric machines, which employ as the armature a cylindrical core mounted in such manner as to be capable of revolution between the polar faces of a system of magnets. The said invention comprises a system or method of winding the armatures of machines which are more especially designed for furnishing currents of high electromotive force; and a system or method of winding the same or similar armatures for the production of currents of low electromotive force but great quantity.

2712. "Electric lamps." W. R. LAKE. (A communication from abroad by F. Krizik and L. Piette, both of Pilsen, Austria.) Dated June 9. This invention relates to electric lamps and is designed to provide improved means for effecting automatically the regulation of the distance apart of the carbon rods or conductors, without the aid of clockwork or other like mechanism, by the use of a solenoid or solenoids having a core made as hereinafter described. Fig. 1 is a side view of a lamp according to this invention, and fig. 2 is a transverse section. A frame, A B C D, carrying the lower carbon, K¹, is guided by rollers, r^1 r^1, and suspended by non-conducting cords which pass over pulleys, R R, and are attached to the lower part of a brass tube, S. This tube is guided by rollers, r r, it carries the upper carbon, K, and has within it the taper iron core, C. The coil of large wire, Z, is wound by steps, as shown in fig. 2, and the coil of fine wire, Y, is oppositely wound in the spaces of the steps. When the lamp is in action the current entering at the positive post passes by the rollers, r r, to the tube, S, thence through the upper carbon, K, the voltaic arc, the lower carbon, K¹, the frame, A B C D, the rollers, r^1 r^1, and their supports, m m, to the stationary framing of the lamp, then through the coil, Z, to the negative post. The upper carbon, K, is maintained at the required distance from the lower carbon, K¹, by the attraction of the solenoid coil, Z, on the taper core, C, and by the weight of the frame, A B C D, and lower carbon, drawing it upwards in opposition to the weight of the core, C, and tube, S, acting downwards. When the distance of the carbons and consequently the resistance of the arc is too small the larger quantity of current passing through the coil, Z, increases its attractive power, causing the carbon, K, to ascend. When the distance of the carbons and consequently the resistance of the arc is too great the attractive power of the coil, Z, is diminished, not only by the reduction of the current passing through it, but also by the weakening influence of the opposite coil, Y, which being in a by-pass receives an increased amount of current, and the carbon, K, descends. Owing to the tapering shape of the core, C, the action above described remains practically uniform notwithstanding its varying position as the carbons are consumed.

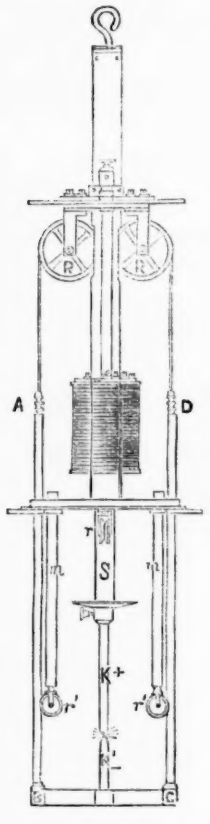


FIG. 1.

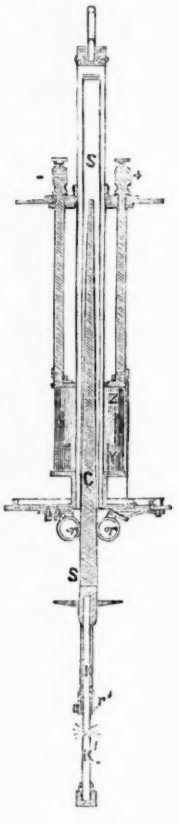


FIG. 2.

2722. "Secondary batteries." A. P. PRICE. Dated June 9. 2d. Relates to improvements in the construction of what are known as secondary batteries, and consists in the employment of what is known as spongy india-rubber or india-rubber sponge in the construction of secondary batteries in a manner similar to that in which porous or permeable materials are now employed, or are capable of being employed in such or in similar batteries. The spongy india-rubber or the india-rubber sponge may be employed in the form of sheets or of cells or in any other form, the object being to employ a porous and permeating material which is not easily acted upon by the acid solutions when placed in secondary batteries.

2740. "Electric lamps." GEMINIANO ZANNI. Dated June 10. 2d. Relates to improvements in that class of electric lighting apparatus in which light is produced by the heating to incandescence of the end or point of a small rod or pencil of carbon (forming the positive electrode) which is forced by weights or equivalent means into contact with a block disc or piece of carbon or metal of large diameter which constitutes the negative electrode. In such lamps as heretofore constructed, it frequently happens that the lamp is either entirely or partially extinguished by reason of a flaw or imperfection in the carbon of which the positive electrode is formed, or by the breakage of the said electrode. The invention is designed to obviate or minimise these defects, and is carried into practice as follows; that is to say, instead of using a single small rod or pencil as the positive electrode in the aforesaid lamps, the inventor employs two or more rods or pencils which are preferably so arranged as to touch each other or be in close proximity to each other. These small rods or pencils are preferably mounted in one and the same carbon-holder, and are fed into contact with the carbon or metal disc constituting the negative electrode by means of weights, or in any other suitable manner. (*Provisional only.*)

2741. "Illuminating conductors for incandescent electric lamps." GEMINIANO ZANNI. Dated June 10. 4d. Relates to illuminating conductors for electric lamps of that class in which the light is developed by the passage of a current of electricity through, or over, a strip or loop of suitable material which is thereby rendered incandescent. The material, such as carbonised cardboard and like substances heretofore used for making the strip or loop which is to emit the light when rendered incandescent by the electricity, is, as is well known, a bad conductor, and as it consequently opposes great resistance to the passage of the current, the battery or other electrical generator must be of considerable power in order to produce the required light in the lamps. The invention is designed to provide strips, pieces, or webs, so made, that while they will be rendered incandescent by the electric current, will offer considerably less resistance to the passage thereof than is the case with the strips or loops heretofore employed, and thus effect a large economy with respect to the expenditure or consumption of electricity. In carrying the said invention into practice the inventor makes, in the following manner, the part which is to be rendered incandescent, that is to say, he provides a core of thin wire which he inserts within a fine Tuscan straw, the latter thus forming a tube around the wire. The whole is then bent to the required form and subjected to heat so that the straw becomes carbonised.

2734. "Governing the feed of electric arc lamps. J. MATHIESON. Dated June 10. 6d. Relates to a novel method of regulating electric arc lamps, whether used as single lamps or in series, the object being to maintain the relative positions of the carbon electrodes by giving to the moving electrode a progressive motion so timed as to make its advance almost imperceptible, and thereby to maintain the steadiness of the light. The invention is an improvement on the Gramme lamp.

2755. "Electric lamps." W. CHADBURN. Dated June 12. 8d. Relates to certain improvements in that class of electric lamps known as arc lamps, and in what are known as dynamo-electric machines. The improvements in the arc lamp consist in a particular arrangement and combination of parts forming the grip, or device, for holding, feeding, and regulating, the upper carbon. Such device is composed of three vertical levers of the first kind, pivoted to a ring suspended by adjustable stops from the top plate, or cover of the lamp. The lower ends of the levers being made to grip the carbon by the upper ends being expanded by a cone, which is moved, or lifted through the agency of the primary solenoid by a lever of the first kind which has its fulcrum attached to the upper plate of the lamp, the other end of the lever being actuated by a shunt solenoid, the lower carbon is suspended and supported by rods attached to, but insulated from the lower plate of the lamp frame, so as to come below and in vertical line with the upper, or adjustable carbon, which latter extends through the upper plate, or frame of the lamp. The primary solenoid and the shunt solenoid are mounted over the top plate of the lamp, and their armatures are made to act as dash pots, a cut out, or resistance coil, and necessary appliances being provided as usual. The carbons are surrounded by a glass globe, and the upper part of the lamp is within a casing, and is provided with a shade.

CITY NOTES, REPORTS, MEETINGS, &c.

British Insulite Company (Limited).

THE second ordinary general meeting of the shareholders of the above-named company was held at the Guildhall Tavern, Gresham Street, on Monday afternoon, the Right Hon. E. P. Bouverie presiding.

The Secretary having read the notice convening the meeting,

The Chairman said: Gentlemen, under our articles of association there is a provision that the annual general meeting shall be held once in every year, and that if no special time or place is prescribed by a general meeting, that meeting shall be held on the first Monday in February in every year. In accordance with that article of association this meeting has been called, for the purpose of submitting to you a statement of accounts and for other ordinary business of the company; and in submitting those accounts and report, which have been sent round to you in print, I shall deem it my duty to occupy your time for a few moments in explaining what the position of the company is. In the first place, I should say, you are aware it has been in existence for about eight months. The latter part of May was the time when the company was formed. Since then we have had to set to work at the board to get the operations of the company set in motion. The accounts which you have in your hands really set forth the position of the company; but there is an ambiguity in one item of those accounts, on the creditor side, which I shall be glad to explain to you. First, there is what has been received on the debtor's side. There is an item debited to "Sundry creditors," and a moiety of this is for directors' fees, which, I should mention, have been unpaid. We thought as the company was inchoate, or not at work, we should not at present draw our fees. That makes one-half of the item of "Sundry creditors" on the debit side. On the other side there is the amount of cash payments and legal expenses, and the first is the item "By patents, machinery, &c." Then come the next five items—2, 3, 4, 5, and 6, beginning at "Leasehold property" and ending "By cash at bankers'," all of which are really assets of the company, as to each of which I should like to say a few words. Leasehold property with improvements have been entered in the accounts at cost; and I shall say something of the site in my general observations. We have established our works, and I should mention we were enabled, after some difficulty, to find what I think is a perfectly appropriate site, and that we bought it at a very low figure with some machinery which was then not in use by the vendor, having belonged to people who had failed, and we got it at a value far less than that which we are told is the real value. The board have had the site—the leasehold which we have got—valued. It is eminently fitted for our purposes; and apart from the machinery which we got therein, which was included in the £1,925, a very competent surveyor, not at all exaggerated in his ideas of the value of property, and with great knowledge and experience of leasehold property, put the lease alone as worth £2,000, and the machinery we got thrown in we have valued to us at about £700. So we made a good bargain. We got for £1,925 what we are told is worth about £2,700. The plant and machinery have been purchased since. That does not include the whole of the plant, nor the material which we have acquired, and which appears as "Stock-in-hand," some of which is of a valuable character, and which we thought it prudent to lay in a good stock of before commencing operations, for fear the price would be raised; and I hear, if sold in the market, it would be worth more than what we gave for it. So it stands as cash or equal to cash in our books. "Cash at bankers'" speaks for itself. Altogether I make out, without going into the valuation of the lease at the higher rate, what we have put it at there shows assets of over £7,000. Then there is the charge for "Preliminary expenses," which always accompanies the establishment of a company, which I do not think is excessive. That would have of course, in future arrangements, to be spread over a short period of years. It is a fair capital charge, a large part of which consists in advertising—more than half. Then there are "Sundry administration expenses," which I can give the details of if they are asked for by the meeting, and of which one-half are already paid. I think what I have said will enable you to see that we in most respects are ready to begin operations, but unfortunately up to the present period we have not been able to commence work. We have got the building and materials, and we wished and hoped to have the machinery. The main part of the profit which is expected to be derived—I may say the whole profit—from the manufacture of this material will be got from making it in a large way and in a cheap and economical manner. The great merits of this patent invention to which we have a right is that it produces a material which is in large request, which is necessary to electric existence, and which can be produced by this process better and cheaper than anything which is known in nature. The result is, if we are right in our anticipation, that there must be a very large demand for a variety of electrical purposes for the stuff we shall be able to produce, and the cheaper the way we can produce it, the larger the profit that will be made by the manufacture. There have been considerable minor improvements made in the method of manufacture since this matter was first invented. An improvement in treating it has been hit upon. Before, it was cut into blocks, but now they had got it to such consistency that they could press it into any shape in moulds. Having to do that on a large scale in a cheap way involved the erection of some more machinery. The first difficulty we had to contend with was to get a place to carry on our works. We wanted them near a railway or the River, as we had to deal with matters of large bulk; and another consideration was that it should be out of the way, because in making the stuff we have to make there are many odours which are supposed to be offensive, and we know by experience in the small works established by the parent company in Westminster, great complaints were made by the authorities as to what was called a nuisance in the neighbourhood, and legal steps were threatened to shut up the works. After making one or two efforts in another direction, we succeeded in finding a site at Charlton which eminently fitted all characteristics—within fifty yards of the station. It has access to the River and to the railway, and is not out of the way, has no population round it, and combines everything we want for the purposes of our manufacture. We have the site on lease for thirty-four years at a moderate rent. Having got the site—this took us some time—we did not get the conveyance till September. Then we set about getting the machinery, but we found the machine makers so full of work that they were very unwilling to promise to have all delivered by a certain time. We have only been able to get the machinery piecemeal, and the last thing which hung fire was the engine, which has only to-day been delivered. The engine-makers had to be written to by our lawyers and the work was hurried on. We hope to get to work in the course of the next two or three weeks, and produce what we propose. Now, of course, with new inventions like this, the expectation that this stuff will be required, that there will be a large demand for it, is, more or less, a speculation. When you have a monopoly of something which people do not care much about, or a thing which is a matter of fashion—say, crinolines—it is possible the demand may cease, or the fashion may change, and that you may be left landed with no real desire—no valuable desire—for that which you produce. But when you produce what may be called a necessary of existence of any kind, and if you have a practical monopoly of it, and if you are able to produce it better and cheaper than any one else, all those who require it must come to you, and you will make a large profit. That is the principle upon which we stand. We believe we have by our patent the right of making something which all electricians must have for use for appliances for telephony and electricity, and for all the various things for which an insulating material is necessary for all electrical operations. One of the commonest things which we are to manufacture are the insulators you see in the telegraph posts. We believe ours will be made cheaper and better than those of porcelain. We have supplied some to the Post-office some months ago, and they have been sufficiently satisfied with the result of their experience of the material as to ask us to make a tender for a large order quite recently. So the result of that must have been satisfactory. But besides that there are an infinite number of things to which insulation is common. We know how largely the development of the application of electricity to ordinary affairs is going on now, and we think we have got something which is a necessary ingredient in that application. If it is true, and I believe it to be true, we have got hold of a very valuable thing, and if the crop is nurtured and is managed in the proper way we ought to have got hold of a very good business. It is in the future and remains to be decided by experience. We have done nothing but laid the foundation. We could not get a site and the machinery all ready-made out of the bowels of the earth or the brains of an inventor. Now we have got that we hope to be able to produce our stuff at a very large profit. I am a full believer in it myself and have a considerable stake in it. Although I belonged to the original parent Insulite Company I not only put what came out of it but a good deal more into this company, and I am satisfied that in a reasonable time it should be a very good property. I do not know whether you will be persuaded, but I hope you will be, of the value of the property you have got hold of; and I hope you will not be deterred from believing, owing to the delays that have taken place, that the property in which you have made a venture is a deteriorated or a damaged one. On the contrary, I believe I am speaking the opinion of the board, as I am my own, when I say there is no reason, as far as I am aware, to believe such to be the case. But we have learned since, and every step we have taken has gone to satisfy me since the company was formed of the great utility of this invention. We have got Dr. Fleming, a gentleman of great knowledge and ability, in the room, and I am glad to say he is a great believer in the concern himself. I am afraid I have kept you at a greater length than I intended; but Dr. Fleming is prepared to show some method in which this material can be practically used. I shall be glad to answer any questions which may be put, and in the meantime I will move that the report and accounts be received and adopted. I am reminded that Sir Wm. Thomson, who is the greatest possible authority on these matters, has written in the strongest terms of praise in this matter. There is no reason to doubt the correctness of his views. They are in confirmation of those we entertain ourselves.

A shareholder seconded the resolution for the adoption of the report and accounts.

Dr. Fleming said, in response to an invitation, he would offer a few remarks. He was well aware of the proverbial sanguineness of the inventor, and he also rose with a sense of the responsibility to keep within the strictest limits of moderation in his remarks. But he thought he might venture to claim a hearing on the ground that he was the largest shareholder in the company, and that as the chairman had said, anything they might have taken out of the old company they had put into this, and more besides. He had with him some samples of materials and articles which they had made, for they had not been altogether idle in the interval. They had been preparing a series of articles which they expected to supply very soon in large quantites. They had before them Sir William Thomson's report on the material, in which he expressed himself to the effect that theirs was an insulating material of exceptional value. He, Dr. Fleming, was perfectly confident that as soon as they were able to produce the telegraph insulators in sufficient quantities they would have practically a very large business. With regard to the cells they made, he felt that they were far preferable to those in use. The cells manufactured by this company could be sent by parcels post ready charged. It could be used for electric bells and burglar alarms with very slight trouble. What limited the use of these appliances was the difficulty of charging the batteries; but their insulite cells

could be charged once for all for a very long time; they could be handled with the greatest freedom, could be thrown about and subjected to pretty rough usage without injury. They had a battery cell and bell combined in such a way that by simply hanging it up against a wall, they had an electric bell ready for action. So a burglar alarm could be attached to a window by merely putting up a bit of wire and connecting it with one of their batteries; and this would ring the moment the window was opened, and not cease till it was closed again (hear, hear). On such work as that they had a monopoly, because glass or earthenware cells could not be sent out ready charged. Another important application of their insulite, which would play no insignificant part in the immediate future, was the manufacture of insulators for the electric railways, for the purpose of insulating the rails. Such insulators as these they had been asked to send to the Portrush Electrical Railway in the North of Ireland which was being laid by the Messrs. Siemens. They had done so, and it had been found that these insulators would do just what they wanted, and almost nothing else would. Glass or earthenware was too easily fractured. In this respect alone they ought to be able to do a large business as soon as they were able to produce it in sufficient quantities. Then another thing which they were able to do in connection with electrical engineering was to produce the electric light. Not one person in a hundred thousand was prepared to meet the cost or inconvenience of a steam-engine and dynamo on their premises, and when they did have a dynamo it required constant vigilance to manage it. The lights might be extinguished in a moment by the slipping of a belt. An accumulator requires to be charged by a dynamo machine. But this company possessed the power of sending out large battery cells—cells of any size, indeed—and with an appliance of that sort, provided it complied with certain conditions of being perfectly true in shape, and so on, and provided with certain plates and chemicals which he need not enlarge upon, and with that it was quite possible to make an installation of electric light. This company could in that way at once supply a demand for electric lighting (hear, hear). It would thus be possible to light a drawing-room or a ball-room easily, cheaply, and brilliantly. This must certainly supply them with a very large field of operations. The battery would run a great many hours—indeed, by a simple contrivance for causing a flow of the chemical fluid through it might be made practically continuous. The first twenty years of this century had been occupied with the development of the steam-engine, the last twenty would certainly be marked by the industrial application of electricity to every department of human life. For that purpose a cheap and easily manufactured insulating material was absolutely necessary. As soon as they had organised their plant, and were prepared to turn this out in large quantities, he felt that they would have an assured success, and he might say that to that matter he was now giving personal attention (hear, hear). He had not the slightest reason to doubt, looking at it quite dispassionately, that he did not see how they could fail very soon indeed to be doing a sound, progressive, and remunerative business (hear, hear).

In reply to a question from Mr. Henry Lefroy, the Chairman said that an ordinary house would require to light it about five cells of such a battery as was exhibited, which would give about twenty-four lights. The cost would depend on the number they could turn out.

Replying to other questions, he said that he did not think their works would cause any annoyance to surrounding dwellings, as they were well isolated. He thought that in about from a fortnight to three weeks they might be able to begin their manufacture, though he could hardly speak positively, they had been so often disappointed.

Mr. Carter would like to know why there had been such delay in getting the engine, which was said to be such a necessary portion of the machinery. Then, again, he had inferred from the chairman's speech that the demand for the article to be manufacturd was purely speculative. How was that to be reconciled with the prospectus, which spoke in such a different tone (hear, hear)?

The Chairman said that the gentleman surely attached a different meaning to the word speculative than he (the chairman) did. He called anything speculative as to which there must be a total want of experience. The success of a new material like theirs could not be gauged by anything that had gone before. Still, speculation in his sense might be as certain as the rising of the sun, and he had every reason to expect that for such a useful product as insulite a large demand would certainly arise when its merits became known. Then as to the machinery, they had first of all to get a place to put it in, as it had to a certain extent to be adapted to the accommodation provided. They had had some trouble, too, about getting their orders placed.

Mr. Carter asked whether they had obtained any orders for the article. He had been told by a shareholder that they had obtained some.

The Chairman said that they had been asked by the Post-office for tenders, and they had besides taken one or two orders in a small way, and they were preparing themselves to execute orders on a large scale. The insulators they had supplied to the Post-office had been paid for.

A Shareholder inquired why no profit and loss account was attached to the report, and complained that the preliminary expenses had been put down as an asset.

The Chairman said that no other account was possible under the circumstances, as they had not yet started as manufacturers. As to the preliminary expenses, they would have to be liquidated from future orders, and they were not put down as assets.

Mr. Edward Harrison said that, although all must have been interested in hearing Dr. Fleming's lucid account, they would all feel that the way in which the company had hitherto been carried on was eminently unsatisfactory (hear, hear). They had been established for nine months and nothing had been done. They were not told how much of the article they could turn out, what would be the cost of it, or what the profit was likely to be. All was as vague as nine months ago. There was no engineer's report, and there had been very great delay about the engine, which might have been, he should say, bought ready-made at a day's notice. He supposed all of the shareholders had received a circular from Mr. Arnold White. Was he going to take any action on that? (Mr. White: I shall take my own course.) He would like to know whether that circular was circulated with the knowledge of the directors. Could they turn out any quantity of this material if they got the orders? Nothing had been done and nothing was being done. He hoped the directors would atone for past neglect by getting to work as soon as possible (hear, hear).

The Chairman thought that the shareholder had no cause to complain of having been misled. (Mr. Harrison: I never said I had been misled.) He gave me that impression at all events. His point was this, however. How could they suppose that a company should be ready to get plant and apparatus, and set to work to manufacture this new substance in a few weeks or even in a few months. The prospectus said that it was intended that a factory on a large scale should be erected. Much time was needed for a work of that description. They could not actually say how many tons of the stuff they could turn out a week; but a large quantity of the more costly material had been got together—nearly £4,000 worth—and they hoped to be able to supply a large demand.

A Shareholder: Is it not a fact that it is not known even up to this moment how to prepare the substance?

The Chairman: It was known perfectly well at the time the patent was taken out, but many minor improvements have been made, in fact Dr. Fleming was always making improvements.

Another Shareholder said that it seemed to him that they had paid £50,000 merely for a recipe.

A third Shareholder said that he thought the chairman's explanations perfectly satisfactory. He could quite see reasons for the delays that had occurred, and he believed that the position of the company was much more favourable than when it was first started.

In reply to a question, the Chairman said that the directors' fees were £400 to the chairman, and to every other director £100, with a further annual sum of £100 each, exclusive of the chairman. He might add that they had not drawn their fees as yet (hear, hear). He might add that as to the manufacture of the company, the greater part of their work could be done by unskilled labour, such as women and boys. There was no difficulty in obtaining the staple material, sawdust, and he believed not very much either about the other ingredients, though they were scattered rather widely. The meetings of the company were to be annual under the articles of association. He would have no objection to meet the shareholders oftener, and they themselves could summon a meeting.

The resolution for the adoption of the report and accounts was then put to the meeting and carried unanimously.

The Chairman then vacated the chair in favour of the Vice-chairman, who moved the re-election of the Right Hon. E. P. Bouverie, M. Moore, Esq., and Dr. Fleming to the board. The motion was carried unanimously, and the chairman resumed the chair.

The motion for the re-election of the auditors was then put and carried on the motion of Mr. Bompas, Q.C., who took occasion to mention the very high opinion which Prof. Stewart, of Cambridge, had recently expressed in his hearing as to the value of insulite and the ability of Dr. Fleming.

The customary vote of thanks to the chairman was then passed by acclamation, and the proceedings terminated.

The Telegraph Construction and Maintenance Company (Limited).

AN extraordinary general meeting of this company was held at the offices of the company, 38, Old Broad Street, on Tuesday, Sir Daniel Gooch, Bart., presiding.

Mr. Dickens (the secretary) read the notice calling the meeting, which explained that it was "for the purpose of considering and, if thought fit passing, a special resolution approving the Bill now pending in Parliament, entitled 'A Bill for Removing Doubts as to and for Extending the Powers of the Telegraph Construction and Maintenance Company (Limited) and for other purposes.'" The principal object of the Bill is to enable the company to carry on the business of constructing and dealing with works and apparatus for electric lighting and other uses to which electricity can be applied. The company at present manufacture insulated wire and electrical instruments for telegraphic purposes, but the memorandum of association does not in terms extend to electric lighting. The directors were of opinion that the company should be empowered to extend its operations to this class of business.

The Chairman said that at present their powers were limited to telegraphs alone, but that since the formation of the company electricity, both for lighting and mechanical purposes, had very largely come into use, and the directors now thought they should try to avail themselves of the machinery and appliances they possessed to conduct business in the other branches of electricity. The necessity of the Bill arose from the fact that they could not alter their Memorandum of Association without going to Parliament. He moved that the Bill be approved.

Sir George Elliott seconded, and the resolution was unanimously carried.

The Chairman: This resolution will have to be confirmed at our next general meeting.

Mr. William Herbert was sure none of the proprietors would have any objection to the Bill. It was carrying out the principle he suggested at a previous meeting, that the company, with its great reputation, its large capital, and its extensive staff of gentlemen well versed in the knowledge of electricity, should identify itself more

with electric lighting and other branches of electricity than hitherto. He therefore was very pleased they had carried out the suggestion. It might appear somewhat late in the day (hear, hear), but he was the first to come before them and renounce his former opinion that they should have proceeded precipitately in carrying out the principle of electric lighting. They were much more likely to be successful now considering they had the experience other companies had given them. He commended the directors for the caution they had exercised (hear, hear).

A vote of thanks to the chairman closed the meeting.

The India-Rubber, Gutta-Percha, and Telegraph Works Company (Limited).

THE directors' report for the year ending December 31st, 1882, states that every department of the company's business has been well employed during the past year. On reference to the accounts a large reduction will be observed in the item debentures and shares in other companies. The year's sales of these securities have realised a considerable profit. The net profit amounts to £192,784 9s. 6d. Adding £21,526 17s. 9d. brought forward from 1881 and deducting £15,600 interim dividend paid in July, there remains a disposable balance of £198,711 7s. 3d. The directors have added £100,000 of this balance to the reserve fund, raising it to £200,000; and they now recommend the distribution of a dividend of £1 per share and a bonus of £1 per share, amounting together to £62,400, and making, with the interim dividend, a total payment for the year of 25 per cent., free of income-tax, carrying forward £36,311 7s. 3d. To enable the company to meet the demands of an increasing business, considerable sums have been and are being expended on the construction of buildings and machinery at Silvertown and at Persan-Beaumont, and additional land has been acquired for the necessary extension of the Persan factory and for obtaining access to the railway. For these purposes, and to provide further working capital, the directors have deemed it necessary to make the addition to the reserve fund stated above. In the cable department contracts have been carried out for the French and Canadian Governments, and for the Central and South American, Mexican, Direct Spanish, West India and Panama, and Western and Brazilian Telegraph Companies. The cables which the company contracted to lay have been successfully completed under the able management of the company's engineer, Mr. Robert Kaye Gray; and he and the entire staff are entitled to the highest commendation. The directors have for some time felt it to be very desirable that accommodation should be provided for the comfort, instruction, and amusement of the workpeople at Silvertown. They will therefore submit a resolution at the coming meeting authorising the expenditure of a sum of £6,000 for the erection of a hall and dining-rooms on the company's property. Further details will be given at the meeting.

The Direct United States Cable Company (Limited).

THE Report of the Directors for the six months ending 31st December, 1882, gives the usual statements of account. For the half-year the revenue, after deducting out-payments, amounted to £77,469 8s. 3d. against £64,514 4s. 4d. (after similar deductions) for the corresponding half-year of 1881, being a difference of £12,955 3s. 11d. in favour of the half-year under review. The working and other expenses, including interest on debentures and income tax, &c., amounted to £22,786 3s. 2d., leaving a balance of £54,683 5s. 1d. as the net profit of the half-year, making, with £282 16s. 8d. brought forward from the previous half-year and £324 12s. 1d. reserved last half-year for law charges, a total balance of £55,290 13s. 10d. For the corresponding half-year of 1881, the working expenses and other payments amounted to £25,574 10s. 2d. Interim dividends of 1¼ per cent. each for the quarter ending 30th September, 1882, paid 16th November, 1882, and for the quarter ending 31st December, 1882, payable 16th February, 1883, together amounting to £30,355 have been declared. The sum of £2,213 4s. 1d., being the balance of preliminary expenses account, has been written off; £21,435 13s. 9d. has been set aside to the reserve fund (thereby increasing that fund to £290,000), leaving a balance of £1,286 16s., which has been carried forward. Last autumn, the promotion of rival Atlantic cables being seriously discussed, Mr. Pender, the chairman, proceeded to America, accompanied by the secretary and traffic manager, for the purpose of ascertaining the character of the threatened competition and the best mode of dealing with it. Whilst there it became clear that the new cables were being promoted owing to the arrangement by which messages to and from the existing cables had to pass through a central office in New York, under the sole control of one land telegraph company. Recognising the importance of obtaining a modification of this arrangement, Mr. Pender entered into negotiations with the Western Union Telegraph Company for enabling the European cable companies to establish a separate and independent office in New York. These negotiations have resulted in the establishment of an independent office at New York in direct communication with the cables of the Direct and French companies by special wires operated by the companies' own staff. All reasonable requirements being thus satisfied, it is believed that the threatened competition has been averted.

The Anglo-American Brush Electric Light Corporation (Limited).

THE poll demanded at the meeting of this corporation on the 23rd ult., was taken on Wednesday last week, and on Monday, the 5th inst., the adjourned meeting was held at the Cannon Street Hotel, Sir H. W. Tyler, M.P., presiding.

The Chairman intimated that his first duty was to give the result of the poll on the amendment to the resolution adopting the report, proposed by Mr. A. Gillet, and seconded by Mr. Allsopp, "That a committee of shareholders be appointed to consider and report upon the affairs, position, and general conduct of the corporation." Shareholders claiming to vote in respect of 27,758 shares attended the adjourned meeting on the 30th ult., in person or by proxy. Votes in respect of 5,670 of such shares had been, upon investigation, disallowed by the scrutineers. In the result, 22,088 votes were allowed by the scrutineers, of which 8,750 were in favour of the amendment and 13,338 were against it, showing a majority against the amendment of 4,588 votes. He had therefore to declare the amendment to be lost. His next duty was to put the original proposition, moved by himself and seconded by Mr. Sellon, "That the directors' report and the balance-sheet now presented for the year ending 30th December, 1882, be, and the same are, hereby approved and adopted."

A show of hands having been taken, the Chairman declared the resolution carried.

The Chairman said the next resolution he had to propose was that the election of Lord Claud J. Hamilton, M.P., as a director of the board be confirmed. They were very sorry at the beginning of last year to lose the services of one of their most valuable directors, Mr. Nettlefold. Lord Claud Hamilton was asked to take his place, and the noble lord's position and character, as well as his business capabilities, would be of the greatest service to the board.

Mr. Sellon seconded, and the resolution was unanimously adopted.

The Chairman then moved that the retiring directors, Messrs. Wm. Ladd, J. I. Courtney, and Mr. J. S. Sellon be re-elected. Mr. Sellon was very much interested in electric lighting, and was a most indefatigable worker; in fact, all of the directors had been bestowing an amount of work in regard to the affairs of the company which would seldom be found to be given by the directors of any company. Mr. Ladd, they would know, was one of the earliest labourers in the field, and had, he thought, produced the first dynamo-electric machine ever worked.

Mr. Gibbs seconded the proposition, which was also unanimously carried.

The Chairman moved that Mr. Alfred E. Jarvis be re-appointed auditor for the ensuing year.

Mr. Nettlefold seconded, stating that Mr. Jarvis had been the auditor of the company since its formation and had done his duty in a very efficient manner.

The motion was carried.

The Chairman had one other resolution to propose, namely, that the directors be authorised to apply for an official quotation on the Stock Exchange in respect of 700 fully paid-up shares.

A Shareholder seconded the resolution and

The Chairman declared it unanimously carried.

Mr. Lane-Fox: I wish to say something in regard to the shares.

The Chairman: But the motion is carried.

Mr. Lane-Fox: Do I understand I am too late?

The Chairman: You are too late.

A Shareholder: It was not clearly put.

The Chairman: It was most clearly put.

Mr. Gillet thought it was most satisfactory that so many shareholders had taken the trouble to record their votes, and he, as one of the scrutineers, fully believed the result of the poll was a satisfactory expression of the general opinion of the body of shareholders.

The Chairman: I am sure we are quite agreed with what Mr. Gillet has said. This concludes the business.

Mr. Nettlefold thought they ought not to allow the meeting to close without a vote of thanks to the chairman ("No, no," and hear, hear). He proposed that a vote of thanks be given to the chairman for presiding that day, and coupled with that they ought to give their best thanks to the directors, who had bestowed so much time, care, and attention on the business of the company.

Mr. Ash seconded, and the motion was carried.

Mr. Bullivant then said: With your permission I should like to say a few words as a director of this company appointed about two years ago. In justice to you and ourselves I think we should tell you what we have done, how we have worked your company since we started. You intrusted us as directors with £238,000 of called-up capital to work the company to the best advantage. With that we had to buy Brush patents. We did that as instructed by you. We then found we had not a quite complete system of electric lighting, and we thought it advisable to secure the incandescent lamp patents of Mr. Lane-Fox, which we did, our arrangement being that we should pay him £5,000 of the shares of the company, that he should participate in half of the money derived from the sale of foreign patents, and that he should also receive 25 per cent. of all the profits made upon the making of the incandescent lamp. Having done that we thought, having a complete system, we ought to make known our system of lighting throughout the world as far as we could. To do that we exhibited, as you know, at the Paris Exhibition. You must remember that at that time electric lighting was not so well known as it is now. We were anxious to show that the system we had got was the best then known, and we went to considerable expense. At the Paris Exhibition we exhibited sixty of our arc lights, and no other system could do so much, and we also lighted about 1,000 incandescent lamps. This will show that our exhibition at Paris did credit to the company. We were then left to carry out your business, and were left with the English patent. The question was, how should we work it? We knew very well that the capital we had issued then, £400,000 was quite an insignificant sum to work so large a district, and we therefore had to consider the best way to go about it. We thought it better to divide England and Scotland into different sections and to sell concessions for these various districts. The result has been that there have been companies formed now, with good boards of directors, to work our system throughout England and Scotland with an issued capital of above £1,500,000, and with an unissued capital, authorised to be issued, of another £1,500,000. We then stand, as far as England and Scotland are

concerned as a manufacturing company. We have now fitted up works with the most improved machinery to enable us to supply electric lighting on the very lowest scale. What have we done besides? We have returned you £238,000 paid-up capital. We have returned you over £275,000. Now, can you point to any other electric lighting company, or any other company at all, that has done anything like so well for their shareholders as we have for you? Can you point to any company ever formed that has established such a business as we have? And remember that whatever business is done, and it will be an enormous business, must bring profit to you. That electric lighting has for a time met with a check there can be no doubt, but it is easily accounted for. Besides having many opponents, the Electric Lighting Act had for a time stopped electric lighting. It has not been decided yet who shall light the different districts—whether the local Boards shall do it, or whether certain companies shall do it. Until these questions are decided there is a check put upon electric lighting (hear, hear). As to the future of electric lighting, I do not suppose there is one in this room that doubts that electric lighting is to be the light of the future, and, if so, is there any other company at the present time in the position, or anything like the position, of our company, or has got so good a system as we have? No; why, therefore, should the meeting be dissatisfied with our property? If we had our original shareholders here they would have looked on the matter in a different light to some gentlemen who are looking on us. I am sure there would be no dissatisfaction expressed with what the directors have done on the part of the original shareholders. We, as directors, cannot regulate the numbers of your shares; it is taken out of our hands altogether. All we have to do is to do the best we possibly can for the shareholders, and I may say, without question, that no company has ever been formed with directors who have worked better for their shareholders than your directors. We work very often all night long—to ten o'clock—and we feel our shareholders ought to be satisfied with us. I am very happy to work for satisfied shareholders, but for dissatisfied shareholders I will not. I shall work on your board until another director can be found to take my place, but as soon as a capable gentleman can be had, I shall certainly resign. I thought it was right you should know what we have done as directors, and therefore these remarks.

The Chairman: It only remains for me to return thanks, and to say that having got over our little difficulty for the moment, our services, and very best services, are now entirely at your disposal. We have had a temporary check, but we still believe in the business, and we shall lose no opportunity of advancing your interests by any amount of energy and labour we can bestow (hear, hear).

The meeting then separated.

The Great Northern Telegraph Company.—

Messrs. C. I. Hambro and Son offer for public subscription, for the Great Northern Telegraph Company, an issue of £300,000 Five per Cent. £100 debentures, with half-yearly coupons attached, payable the 1st of March and 1st of September in each year. The first coupon will be payable on the 1st of September, 1883. The price is £101 for each £100 debenture, payable £5 per cent. on application, £5 per cent. on allotment, and £91 per cent. on the 1st of March, from which date the debentures bear interest. Allotment letters will be exchanged for debentures after payment of the balance due on the 1st of March, 1883.

The Cuba Submarine Telegraph Company

(Limited).—The number of messages passing over the lines of this company during the month of January was 2,953, estimated to produce £2,800, against 3,029 messages, producing £3,021, in the corresponding month of last year.

The Albo-Carbon Light Company (Limited).—

The directors of this company have decided to distribute out of the profits ascertained as earned in the half-year ending 31st December last, a dividend at the rate of 15 per cent. per annum, free of income-tax.

The Eastern Extension, Australasia, and China Telegraph Company (Limited).—

The issue is announced of 50,250 shares of £10 each of the unissued capital, as on the 25th January, at £1 premium, payable £5 on the 15th February, £3 on 31st March, and £3 on 30th June. A proportionate dividend will accrue on these shares from the dates of the payment of the respective instalments. The shares are to be offered to the shareholders rateably as nearly as may be in proportion to their holdings. The coupon on Six per Cent. Debentures, due on the 1st inst., will be paid on and after that date, at the Consolidated Bank, 52, Threadneedle Street, E.C. Coupons must be left three clear days for examination.

The Eastern Telegraph Company, Limited.—

This Company state that the coupons on their 5 per Cent. Debentures will be paid on and after the 1st of February, by Messrs. Glynn, Mills, Currie, & Co. Coupons should be left three days clear for examination.

Calls.—A call of £1 was due on the 1st inst. on the £5 paid shares of the Anglo-American Brush Electric Light Corporation, and a similar call was due on the same date on the shares of the Eastern Electric Light and Power Company. On the new £10 shares, issued at £11, of the Eastern Extension, Australasia, and China Telegraph Company a call of £5 is due on the 15th inst. A call of £3 is also due on the 15th inst. on the preference shares of £20, issued at £12, of the French Electrical Power Storage Company, £3 being already paid.

The Stock Exchange Committee have ordered the following security to be officially quoted:—Oriental Telephone Company, Limited, 20,000 new shares.

Important United States Telephone Decision.—

Judge Gray, of the United States Circuit Court, has granted an injunction against the People's Telephone Company (Dolbear's patent), in favour of the Bell Telephone Company. The decision is the culmination of a long litigation, and is considered an essential victory by the Bell Telephone Company. Judge Gray, in his decision, takes the ground that Mr. Bell was the first inventor who successfully used the electric current for the transmission of articular sound. The differences of Dolbear's and Bell's plans are not such as to warrant the former to claim an invention of the entire system.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid	Closing Quotations. Feb. 7.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	6	6 - 6¼	6⅜ 6⅜ 6¼ 6⅜ 6⅜ 6⅜ 6⅜
		Do. Do.	10	9½ - 10½	
30,000	5	Australasian Electric Light, Power & Storage Co.	3	¼ - ⅜	
24,900	10	British Insulite Co., Limited, "A" Shares	5	2 - 3	
30,000	5	Brush Electric Light & Power Co. (Scotland)	2½	¼ - ⅜	
25,000	5	Great Western Electric Light & Power Co.	2½	¼ - ⅜	⅜
24,980	5	Hammond Electric Light & Power Supply Co.	2½	3⅛ - 3½	3⅛ ¼
40,000	5	Indian & Oriental Electrical Storage Works Co.	2	¾ - 1	
172,500	1	Maxim-Weston Electric Light and Power Co.	1	½ - ⅝	
40,000	5	Pilsen-Joel & General Electric Light Co.	2	¾ - 1½	
..	..	South African Brush Electric Light & Power Co.	2½	¾ - 1½	
100,000	5	Swan United Electric Light Co., Limited	2½	2½ - 2⅝	2⅝
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	50½ - 51¼	51
2,441,800*l.*	Stk.	Do. Preferred (Def'd. receiving no div. until)	100	83 -84	83¼ ½
2,441,800*l.*	Stk.	Do. Deferred (6 p. c. has been paid to Pref.)	100	18½ - 19	18¾ ¾
130,000	10	Brazilian Submarine, Limited	10	12½ - 12⅝	12⅝ ⅝
16,000	10	Cuba, Limited	10	10 - 10½	
6,000	10	Do. 10 per cent. Preference	10	17 - 18	
13,000	10	Direct Spanish, Limited	9	6½ - 6¾	
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
65,000	20	Direct United States Cable, Limited, 1877	20	12½ - 12⅝	xd.
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	100 -103	
380,000	10	Eastern, Limited	10	10⅞ - 11¼	11.10⅞
70,000	10	Do. 6 per cent. Preference	10	13 - 13½	13⅜
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	100 -103	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	xd.
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	103 -105	xd.
199,750	12	Eastern Extension, Australasia & China, Limited	10	11⅜ - 11⅝	11⅜
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	106 -109	xd.
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	103 -106	105
140,000	100	Do. do. registered, repayable 1900	100	103 -106	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	103 -106	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	103 -106	103½
345,700*l.*	100	Do. do. do. To Bearer	100	103 -103	
22,050	10	German Union Telegraph and Trust, Limited	10	10 - 10½	10½ xd.
163,390	10	Globe Telegraph and Trust, Limited	10	6⅜ - 6¾	6⅝
163,209	10	Do. 6 per cent. Preference	10	12½ - 12⅝	12⅝ ⅝
125,000	10	Great Northern	10	12 - 12½	12⅜
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	31½ - 32½	32½ ½
100,000	100	Do. 6 per cent. Debentures, 1886	100	105 -108	
17,000	25	Indo-European, Limited	25	32 - 33	
38,148	10	London Platino-Brazilian, Limited	10	4⅜ - 4⅝	
12,060	10	Mediterranean Extension, Limited	10	1⅝ - 2⅛	1⅝
8,200	10	Do. 8 per cent. Preference	10	6 - 8	
9,000	8	Reuter's, Limited	8	10½ - 11	10½ ½ ½ ½
280,000	Stk.	Submarine	100	255 -260	260
58,225	1	Do. Scrip	1	2⅛ - 2⅜	
4,200	Cert.	Submarine Cables Trust	100	105 -109	
37,350	12	Telegraph Construction and Maintenance	12	33 - 34	33⅝
150,000	100	Do. 6 per cent. Bonds, 1884	100	100 -103	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1⅛ - 1⅜	
30,000	10	West Coast of America, Limited	10	4⅜ - 5⅛	
150,000	100	Do. 8 per cent. Debentures	..	..	
69,910	20	Western and Brazilian, Limited	20	7⅜ - 8	7⅞
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	102 -105	xd.
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	97 -100	98 xd
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building)Bds.	$1,000	122 -126	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1½ - 1⅝	
34,563	10	Do. 6 per cent. 1st Preference	10	7 - 7½	
4,669	10	Do. 6 do. 2nd do.	10	5 - 5½	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	⅜ - ½	⅜ ⅜
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	⅜	⅜ - ½	⅜
20,000		Do. New	⅜	⅜ - ½	
100,000	5	United Telephone Co.	5	11½ - 12	11⅞ ⅞ ⅞ 11⅞ 11⅞ ⅞ ⅞ ⅞ ⅞

TRAFFIC RECEIPTS.

The Great Northern Telegraph Company. The traffic receipts for January, 1883, amounted to £18,240; for the corresponding month of 1882, £17,110; and for the same month of 1881, £17,352.

The West India and Panama Telegraph Company, Limited. The estimated traffic receipts for the half-month ending January 31st, 1883, are £2,551, as compared with £2,851 in the corresponding period of 1882.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending February 2nd, 1883, were £2,638, after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The Direct Spanish Telegraph Company, Limited. The estimated traffic receipts for the month of January, 1883, were £1,689, as against £2,055 in the corresponding period of last year.

The Cuba Submarine Telegraph Company, Limited. The traffic receipts for the month of October, 1882, estimated at £2,000, realised £1,986.